Compressed Air

Magazine

APRIL 1946

BOULDER DAM FROM THE AIR

World's highest dam now in its tenth year of valuable service.

VOLUME 51 • NUMBER 4 NEW YORK • LONDON

LIFT

Don't overlook the MOVE factor in hoisting..

LOWER

We've told you about the lifting and lowering features of our hoists, how the air motor is ideal for hot, gaseous atmosphere—the graduated throttle valve that gives instant and complete control—the automatic safety up-and down-stop—the automatic brake for holding loads, etc. But, we have taken one feature too much for granted and that has been our Articulated Type Trolley.

The trolley provides the MOVE in hoisting. If it is not a smoothly operating trolley, it can account for more than one headache and many minutes lost.

Briefly, here's what we want you to know about the I-R hoist trolley:

1—One bracket is rigid to stabilize the hoist and the other bracket is hinged, thus—

2—The load is always equalized on all four wheels.

3—The spherical wheel treads give one point contact for easy rolling and permit use on beams with flat or sloped flanges.

4—The trolley wheels have a hardened and ground tread and are fitted with—

5—High-grade ball bearings to provide smooth movement.

Our Industrial Air Motor Hoists are available in capacities from 300 to 20,000 pounds. Units can be furnished with a plain or hand-chain-driven trolley (both articulated) in place of the standard top hook. A four-wheel-drive, air-motor-driven trolley is also available.

Write for full particulars on Ingersoll-Rand Air Hoists.

AIR TOOLS
COMPRESSORS
ROCK DRILLS
TURBO BLOWERS
CONDENSERS
CENTRIFUGAL PUMPS
OIL & GAS ENGINES

IR

Ingersoll-Rand

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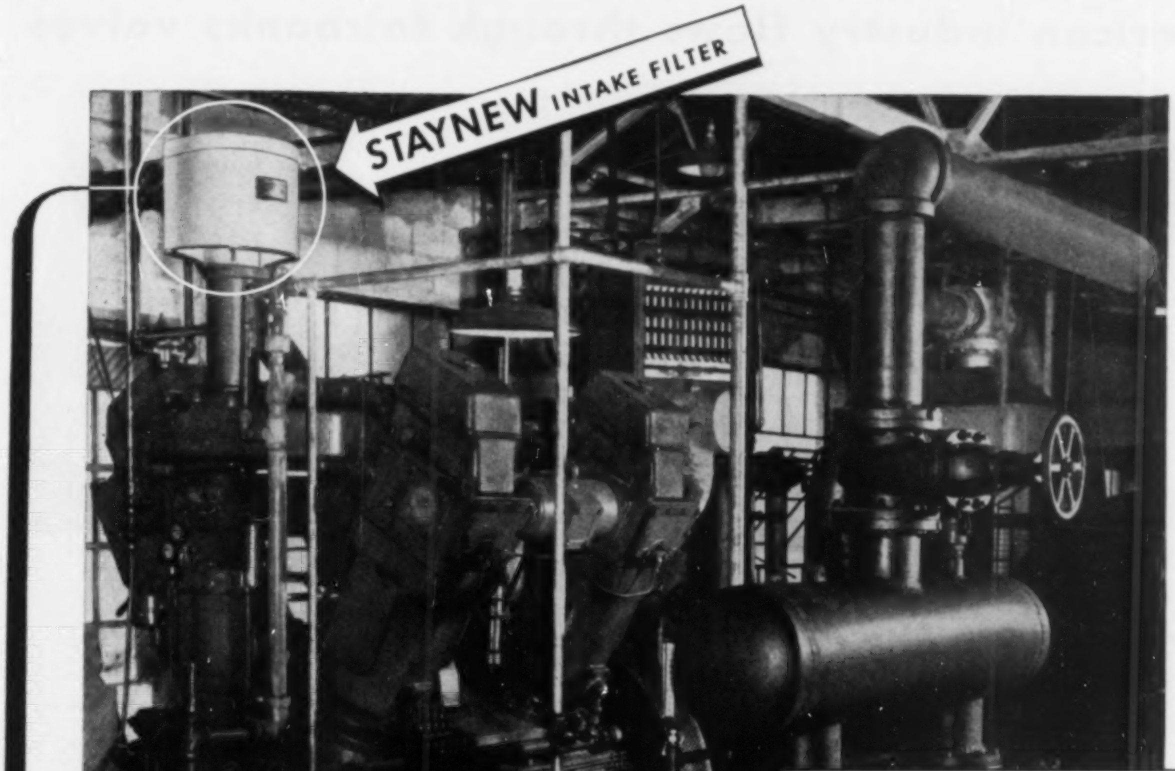
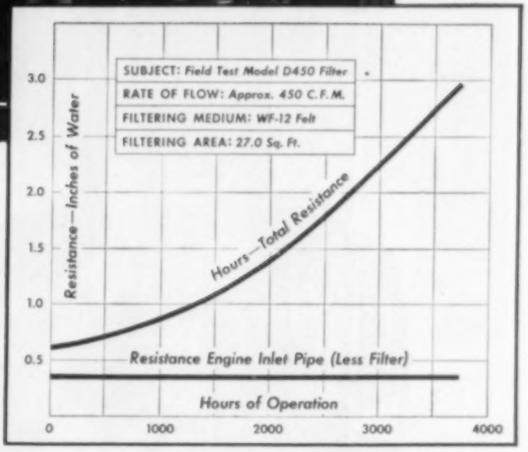
8-833





3761 HOURS CONTINUOUS OPERATION WITHOUT ATTENTION

Yet Filter Resistance Is Only 2.73 Inches of Water

This filter, installed on a Diesel-powered compressor, operates under unusually severe conditions. Intake air is heavily loaded with dust and oil; the dust due to the close proximity of a railroad siding where bulk lime, sand, and coal are handled—the oil to two additional Diesel-powered compressors operating in the same room.

Such a case history is not unusual. Reports are frequently received of Staynew Filters operating under less severe conditions for two or more years without attention—with the initially high efficiency rising as dust load increases.

Ease of cleaning as well as infrequency of cleaning is also an important feature, requiring only a few minutes with the specially designed Staynew Cleaning Nozzle.

More and more experienced operators of compressor and engine equipment specify Staynew Intake Filters—not only because of the minimum attention required, but also because these filters:

★ **Provide positive protection**
★ **Require no pre-coat or filter aid**
★ **Are unaffected by extremes of temperature**
★ **Permit use of oversize filters (air velocity not critical)**
★ **Are ideal for use with carbon ring compressors**

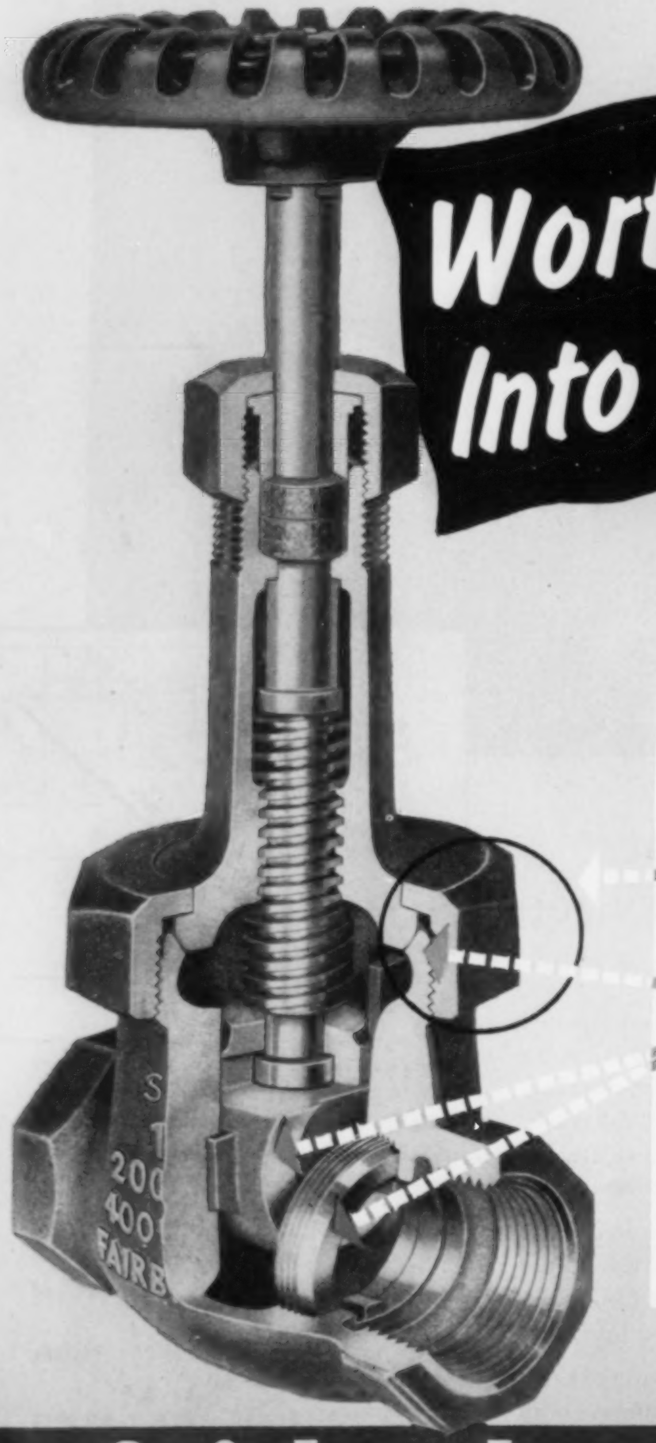
DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

7 CENTRE PK., ROCHESTER 3, N. Y.

Representatives in Principal Cities

American industry flows through fairbanks valves



Worth Looking Into

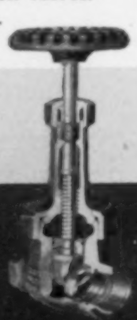
...One Fairbanks Valve
...Three Fairbanks Features

Union Bonnet Bronze Gate Valve for 200 lbs. Steam, 400 lbs. Water, Oil and Gas Pressure (Non-Shock)

While no picture can do full justice to ruggedness of design and construction, the big cutaway view gives you at a glance the most important features of a widely applicable valve suited for severe operating conditions in processing and other work.

- Union bonnet construction provides for easy dismantling and reassembly where frequent cleaning or inspection is necessary. Threads on outside of body are not subject to attack by fluids in line.
- Heavy octagonal bonnet nut holds radial body bonnet joint in pressure-tight alignment.
- Nickel alloy wedges and renewable seat rings provide extra long service through hardness and resistance to corrosion under pressure. Valve may also be had with integral bronze seats.

This valve is furnished with rising or non-rising stem. Low in maintenance cost, this 200 lb. bronze gate valve is typical of the Fairbanks line of bronze, iron body, and all-iron valves. Write today for further information.



THE fairbanks COMPANY

393 LAFAYETTE STREET, NEW YORK 3, N. Y.

520 Atlantic Ave., Boston 10, Mass. | 748 M & M Bldg., Houston 2, Texas | 15 Ferry St., Pittsburgh 22, Pa.

IT'S WORTH LOOKING INTO BY EVERY INDUSTRIAL DISTRIBUTOR interested in a feature-crammed profit-building valve item "made to order for orders" . . . strongly backed by the long-established name of a well-known manufacturer.

HOW TO KEEP DRILLS RUST-FREE

DRILLS protected with *Texaco Rock Drill Lubricants* (*E.P.*) *won't rust*—either in service, standby, or storage. *Texaco Rock Drill Lubricants* (*E.P.*) resist washout. They are especially designed to lubricate effectively at all temperatures, to protect all parts against wear under the most severe loads. They have no objectionable odor.

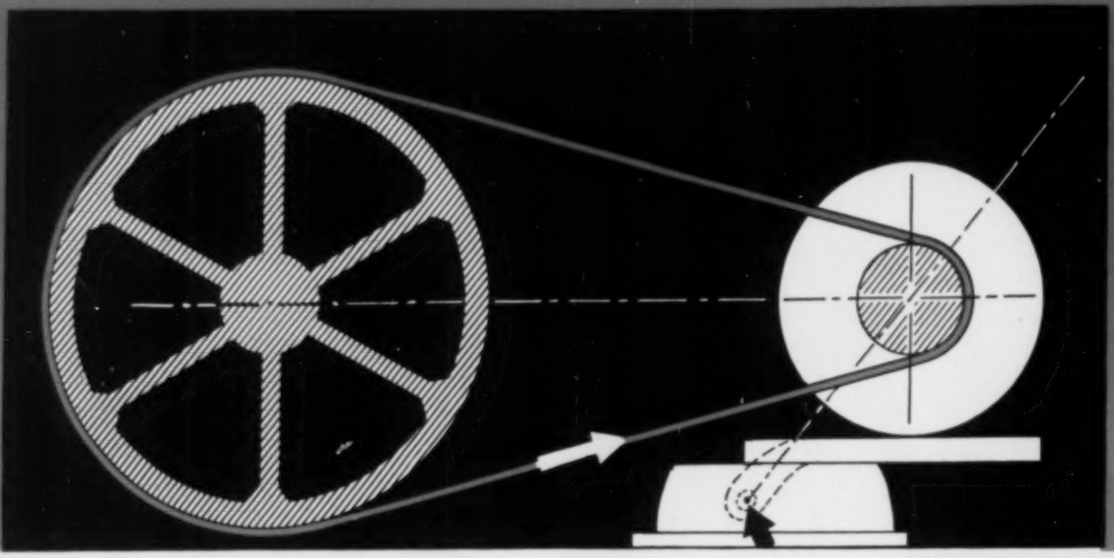
Use *Texaco Rock Drill Lubricants* (*E.P.*) to help you drill greater footage, reduce your service costs, extend the life of your drills. They meet the requirements of every drill design and operating condition and conform to the lubrication standards set by leading rock drill manufacturers.

For Texaco Products and Engineering Service, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO Rock Drill Lubricants (E. P.)

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT—CBS

TESTED RELIABILITY FOR YEARS OF CONTINUOUS SERVICE



MAXIMUM OUTPUT . . . with Little Attention or Expense

Tannate **flat leather belt** has a very high coefficient of friction and great pliability that helps keep machines running at top speed. It is treated to resist moisture, oil and weak acids. TANNATE has unusually high tensile strength which contributes toward increased service life and reduced maintenance expense.

Rockwood **motor base,** one or both pulleys and the belt are supplied by Rhoads. Designed to work together, they give superior performance. Maximum speed is maintained and driven machine capacity is increased when TANNATE-ROCKWOOD flat belt units are put on your drives. Get the most efficient and economical drives for your machines. Ask for further details.

J. E. RHOADS & SONS 35 N. SIXTH ST., PHILA. 6, PA.
Established 1702 NEW YORK • CHICAGO • ATLANTA

RHOADS *Tannate-Rockwood* SHORT CENTER DRIVE

Close Quarters---
SWING CONTROL

But Inexpensive Loading

Shown above is a Model 12-B Eimco RockerShovel operating at Colorado Fluorspar Mines, Inc. at Salida Colorado. Average daily tonnage for two shifts is about 125 tons with this one loader. Maximum tonnage for two shifts is 240 tons. This loader has been in operation about 10 months in which time it has loaded approximately 30,000 tons of ore. The actual repair parts cost at this time is negligible (about .001 cents per ton loaded).

Note the swing control being used (inset) to prevent the bucket from swinging into the timbers. EIMCO Engineers will be glad to consult with you on your loading problems. Write for more information on RockerShovels.

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturer of Underground Rock Loading Machines

Executive Offices and Factories: Salt Lake City 8, Utah
Branches: New York, Chicago, El Paso, Sacramento, St. Louis Aill

The FOURTH Everdur Well Screen installed for the City of Elkhart...

38" diameter well screen fabricated of Everdur 1010 sheet, .203" thickness and welded with Everdur rod. Fourth installation made for the City of Elkhart, by Layne-Northern Company, Mishawaka, Ind., affiliate of Layne & Bowler, Inc., Memphis, Tenn.

NINE YEARS AGO the Layne-Northern Company, Mishawaka, Indiana, installed two wells for the City of Elkhart . . . using well screens made of Everdur*. Because of the high strength and corrosion resistance of this copper-silicon alloy, these two wells have shown no appreciable drop in water yield, although wells with screens of other materials became clogged in a relatively short time.

Two more wells subsequently installed by Layne-Northern were therefore equipped with Everdur. The snapshot above shows the latest installation, with an Everdur well screen ready to be lowered into position. Standing by are Mr. Richard B. Corns (left), Waterworks Superintendent, and his assistant, Mr. Swartz.

The performance of these Everdur well screens is typical of the service rendered by equipment made of this tough, corrosion-resistant alloy . . . installations of which are still in service after 18 years. For detailed information, write for Publications E-11 and E-6.

46209 A

*Reg. U. S. Pat. Off.

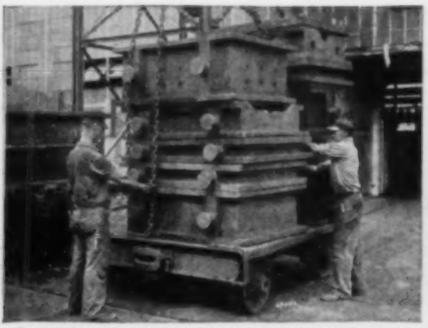
ANACONDA

Everdur

COPPER-SILICON ALLOY

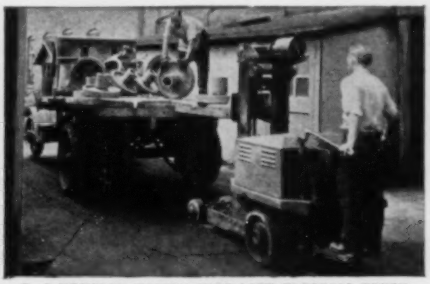
THE AMERICAN BRASS COMPANY
General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

1. EASTON TIER-LIFT ELECTRIC PLATFORM TRUCK

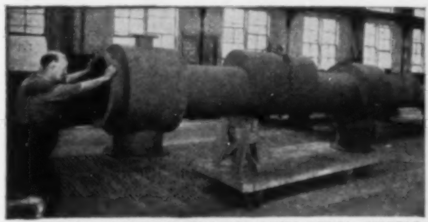

2. EASTON 20-TON CAR HANDLING FOUNDRY MOLDS

3. EASTON SPECIAL LARGE CAPACITY CORE-OVEN CAR

4. EASTON 2-TON RUBBER-TIRED PLATFORM TRAILER


5. A VETERAN EASTON TIER-LIFT ELECTRIC TRUCK

6. EASTON RUBBER-TIRED STOCKROOM TRAILER


7. EASTON PLATFORM TRAILER WITH STEEL WHEELS

8. EASTON LOW-LIFT TRUCK PUSHING PLATFORM CAR

9. TWO EASTON 40-TON DOUBLE-TRUCK PLATFORM CARS

10. EASTON LOW-LIFT ELECTRIC PLATFORM TRUCK

11. EASTON 5-TON PLATFORM CAR, TIMKEN BEARINGS

12. EASTON OPEN FRAME TRAILER, 5000 LBS. CAPACITY

AN INTEGRATED ENGINEERING SERVICE TO MEET YOUR HANDLING PROBLEMS . . .

ALL of these EASTON-engineered electric lift trucks, industrial cars and trailers are serving *one* manufacturing plant. The complexity of light and heavy, routine and highly specialized handling and production operations helps to illustrate the scope of EASTON's integrated engineering service. Plant managers and engineers who are faced with a similar variety of flow and handling problems find it convenient and helpful to refer their questions to

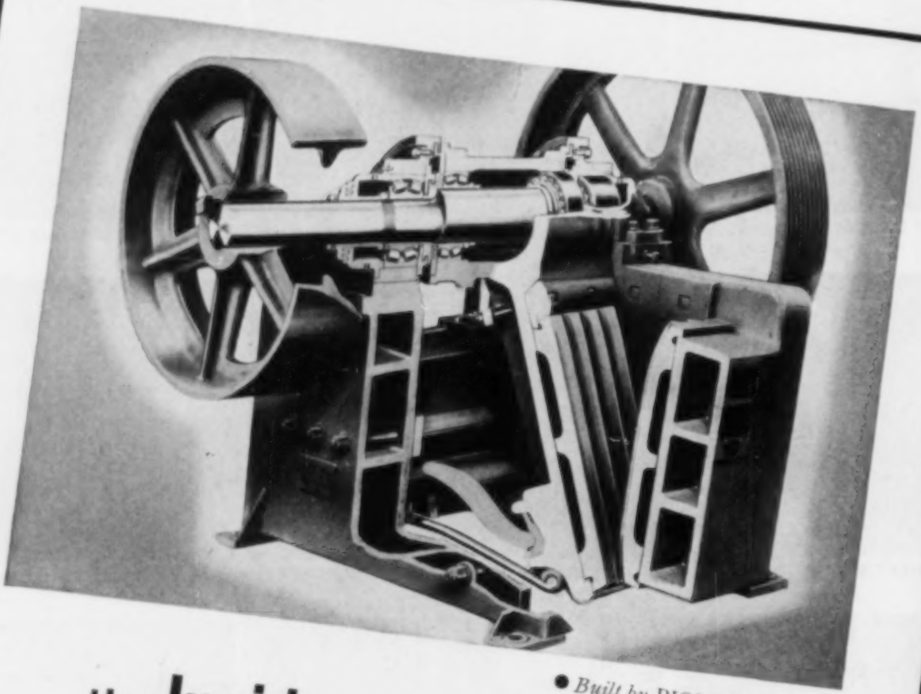
Engineering Counsel, Easton Car & Construction Co., Easton, Pa.

EASTON

TRAILERS · TRUCK BODIES
CARS · ELECTRIC TRUCKS

ENGINEERED

A-1009



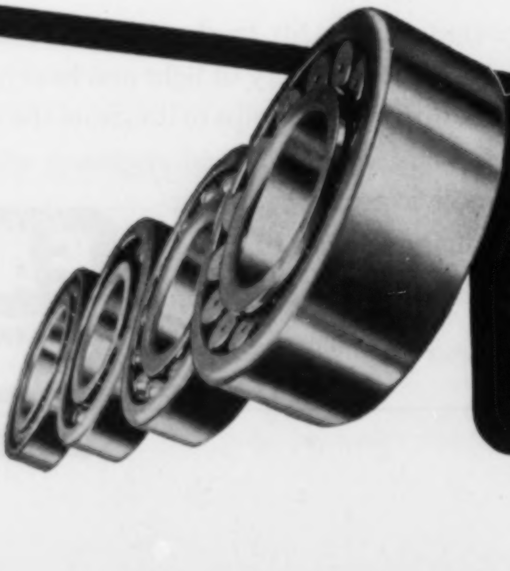
● *Built by* PIONEER ENG'G WORKS, INC.

the Inside story of jaw crusher performance

This ruggedly-designed Jaw Crusher's performance is a tribute to SKF Performance. On the *down* stroke, the upper part of the jaw crushes large rocks. On the *up* stroke, the lower end of the moving jaw has a reversed action and crushes small rocks. That means loads—heavy shock loads—but they don't faze SKF Spherical Roller Bearings a bit. They have *rolling alignment* that prevents binding and loss of bearing capacity under shaft deflections due to high stresses. They need only occasional lubrication, and they are almost frictionless, even when starting under full load. Naturally, the result is *low operating costs.* Something to consider when you buy equipment for low bids on building materials.

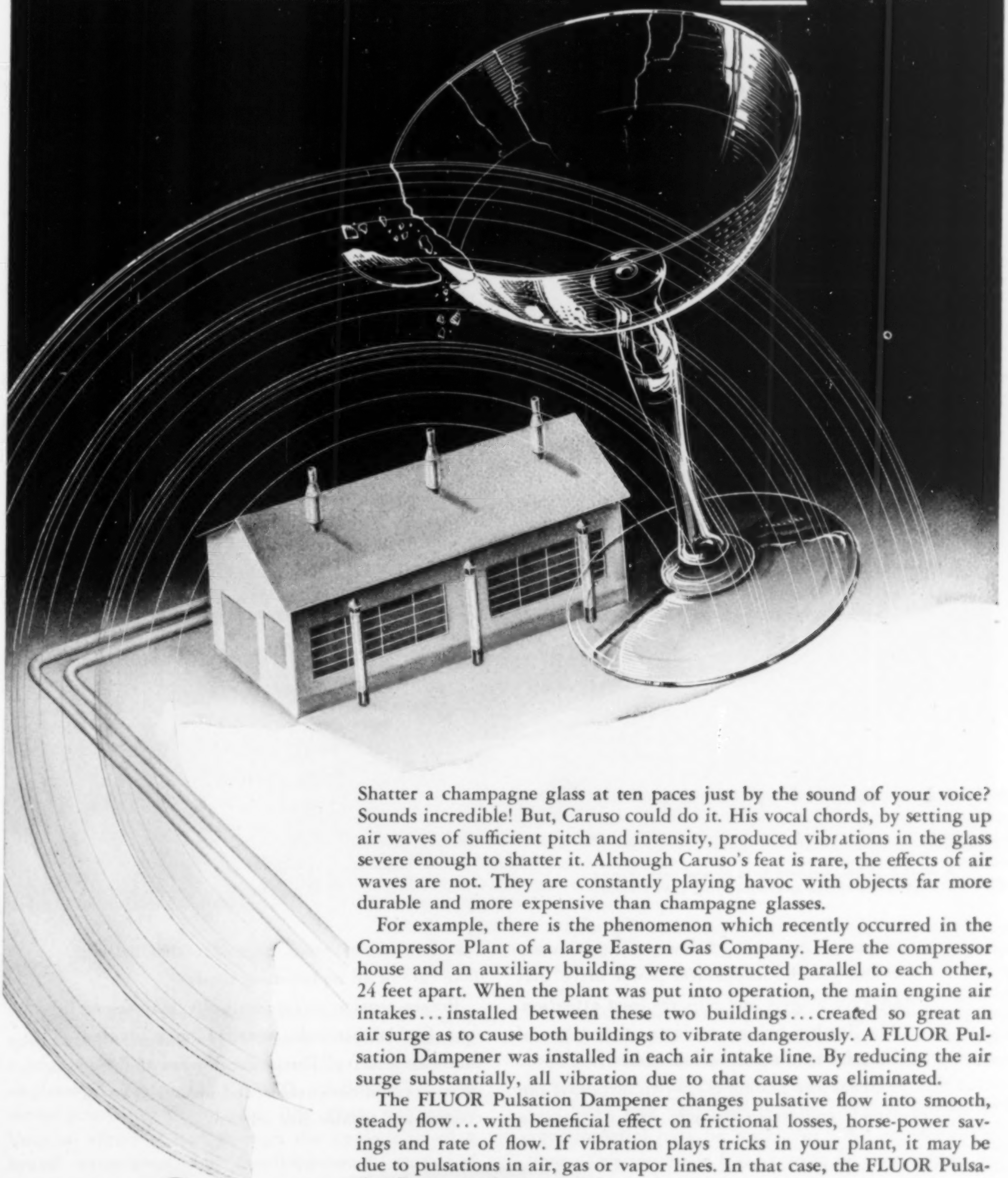
5973

SKF INDUSTRIES, INC.
Front St. & Erie Ave., Phila. 34, Pa.



SKF
Puts the
RIGHT BEARING
in the
RIGHT PLACE

DOES PULSATION PLAY TRICKS IN YOUR PLANT?



Shatter a champagne glass at ten paces just by the sound of your voice? Sounds incredible! But, Caruso could do it. His vocal chords, by setting up air waves of sufficient pitch and intensity, produced vibrations in the glass severe enough to shatter it. Although Caruso's feat is rare, the effects of air waves are not. They are constantly playing havoc with objects far more durable and more expensive than champagne glasses.

For example, there is the phenomenon which recently occurred in the Compressor Plant of a large Eastern Gas Company. Here the compressor house and an auxiliary building were constructed parallel to each other, 24 feet apart. When the plant was put into operation, the main engine air intakes... installed between these two buildings... created so great an air surge as to cause both buildings to vibrate dangerously. A FLUOR Pulsation Dampener was installed in each air intake line. By reducing the air surge substantially, all vibration due to that cause was eliminated.

The FLUOR Pulsation Dampener changes pulsative flow into smooth, steady flow... with beneficial effect on frictional losses, horse-power savings and rate of flow. If vibration plays tricks in your plant, it may be due to pulsations in air, gas or vapor lines. In that case, the FLUOR Pulsation Dampener is your answer.

fc
SINCE
1890

FLUOR PULSATION DAMPENER

THE FLUOR CORPORATION LTD., 2500 South Atlantic Boulevard, Los Angeles 22
NEW YORK • PITTSBURGH • KANSAS CITY • HOUSTON • TULSA • BOSTON

ENGINEERS • MANUFACTURERS • CONSTRUCTORS

Leather Belting

DOES THIS JOB BEST

ENGINEERS AGREE . . . that continuous, trouble-free power-transmission demands the advantages of the Short-Center, Flat Leather Belt Pivoted Motor-Base Drive.

A 60-H.P. motor, mounted on a pivoted base, driving a single-stage air compressor in a big steel foundry.

Designing? Specifying? For your new compressors get the mechanical power drive that stands up longest and requires least attention.

Flat leather belting outlasts other types of belting by two, three, or four times.

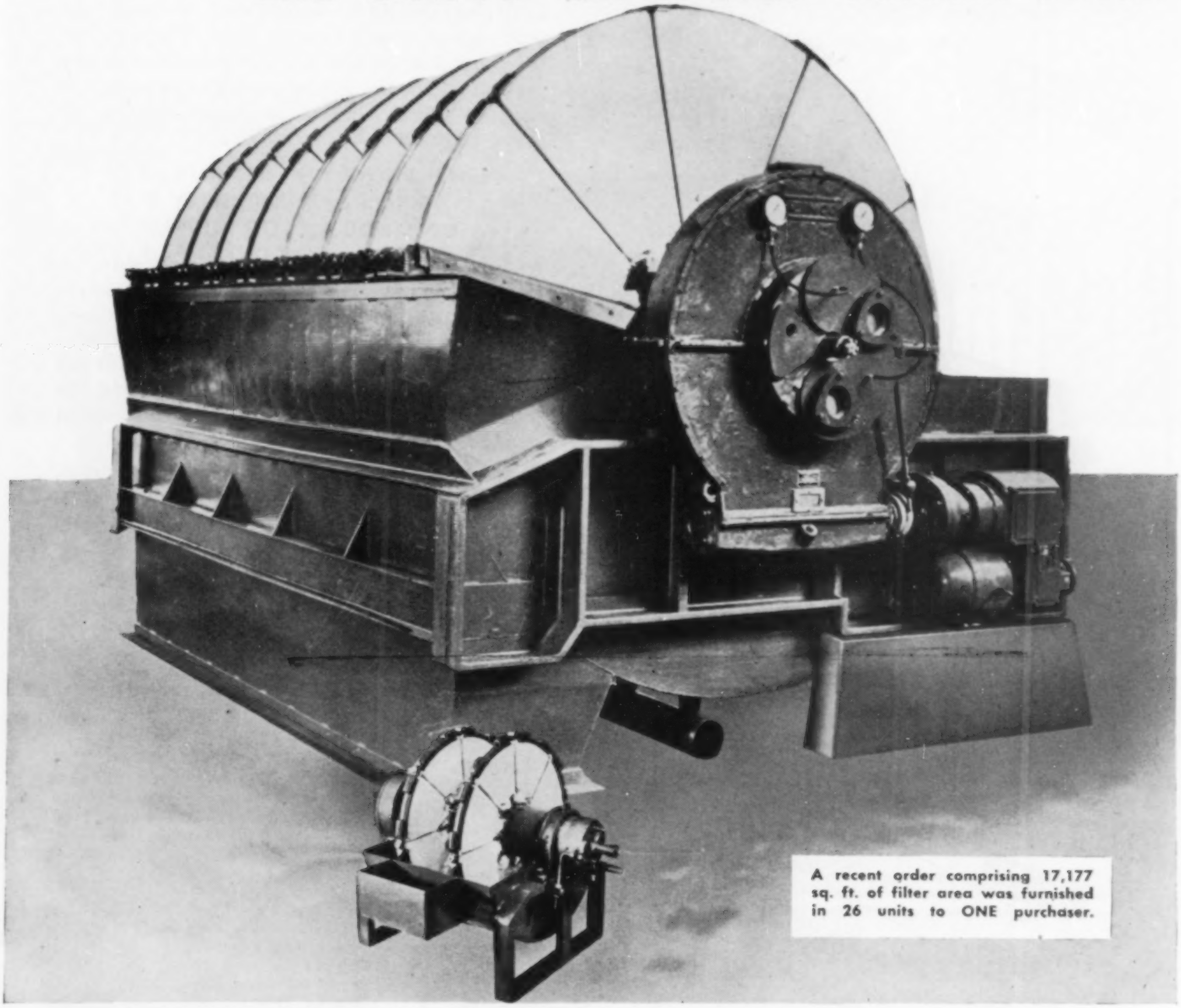
Flat leather belting is easy to install; it can be made endless on the job. And it's easy to maintain. A few stock sizes of leather belting take care of all replacement needs.

Proper tension is automatically maintained in a flat leather belt, installed on a pivoted motor-base drive. This reduces wear and tear on motor and compressor, and insures years of continuous, trouble-free service.

Leave it to Leather!

AMERICAN LEATHER BELTING ASSOCIATION · 41 Park Row, NEW YORK 7, N. Y.

Specialization
and EIMCO Continuous Vacuum Filters



A recent order comprising 17,177 sq. ft. of filter area was furnished in 26 units to ONE purchaser.

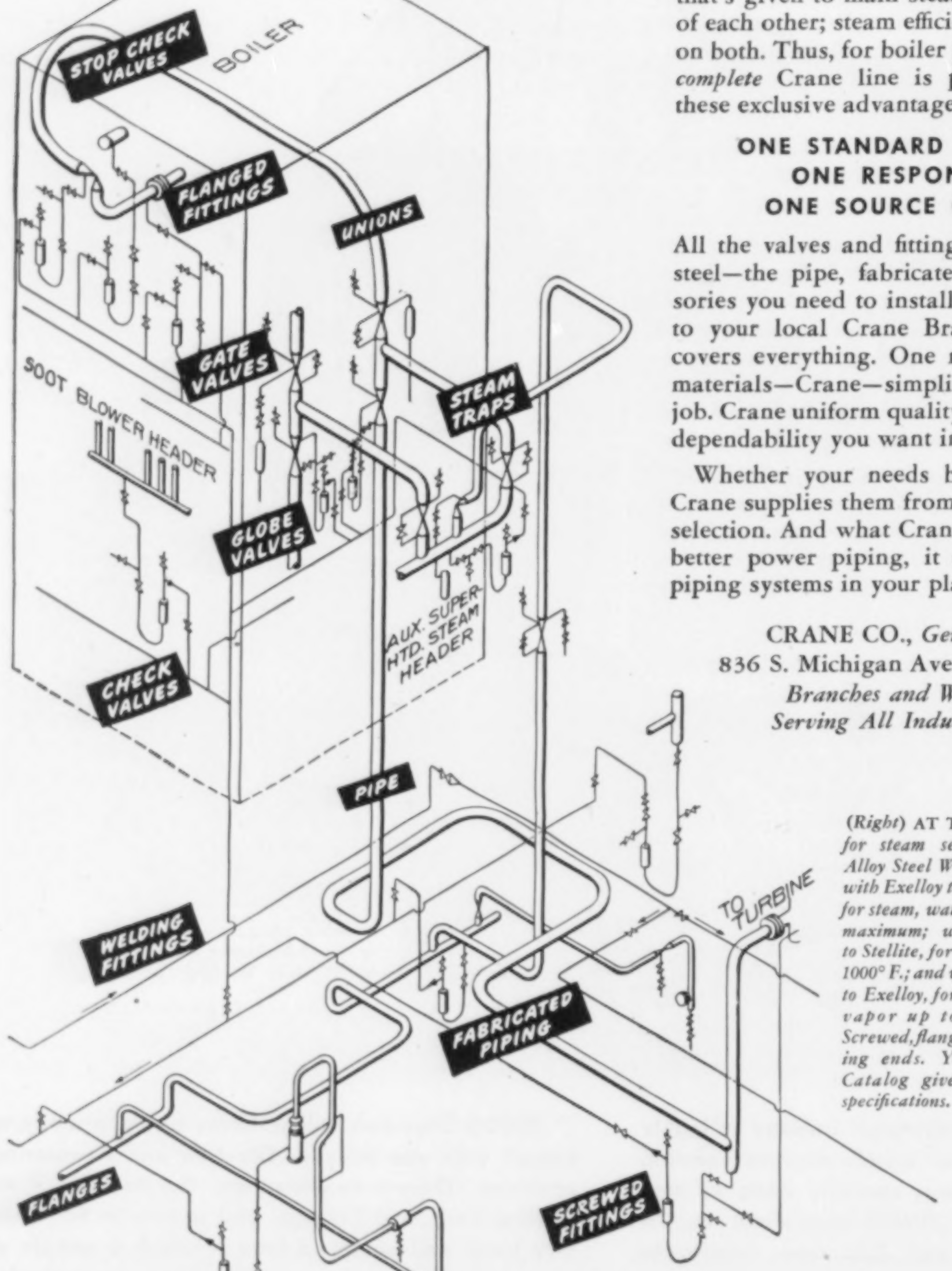
Each step in the Metallurgical Industry is highly specialized. Separation of metals requires exacting methods and in most cases specially designed and engineered equipment. EIMCO specializes in the manufacture of Drum and Disc type Continuous Vacuum Filters — and through the application of a broad experience and "on-the-ground" study of metallurgical problems has furnished hundreds of filtration units to the Industry from the small laboratory filter with two (2) square feet to massive single machines with 2400 square feet of filtering area. EIMCO specialization insures quality of material and workmanship, efficiency with low initial and maintenance cost.

EIMCO Engineers will welcome an opportunity to consult with you on your filtration and dewatering problems. There is no obligation. Our Branch Offices in New York, and Chicago, and factory in Salt Lake City have well equipped labs in which a sample of your material may be tested for filter recommendations. This service is free — write for instructions on shipping sample.

EIMCO
THE EIMCO CORPORATION

Executive Offices and Factories: Salt Lake City 8, Utah
A-109 Branches: New York, Chicago, El Paso, Sacramento, St. Louis

All Drip and Drain Piping
... from the Complete Crane Line


STOP CHECK VALVES
BOILER
FLANGED FITTINGS
UNIONS
GATE VALVES
SOOT BLOWER HEADER
STEAM TRAPS
GLOBE VALVES
AUX. SUPER HTD. STEAM HEADER
CHECK VALVES
PIPE
TO TURBINE
WELDING FITTINGS
FABRICATED PIPING
FLANGES
SCREWED FITTINGS

Drip lines should be erected with the same care that's given to main steam lines. They're part of each other; steam efficiency depends equally on both. Thus, for boiler piping especially, the *complete* Crane line is preferred because of these exclusive advantages:

ONE STANDARD OF QUALITY
ONE RESPONSIBILITY
ONE SOURCE OF SUPPLY

All the valves and fittings, in brass, iron, or steel—the pipe, fabricated piping and accessories you need to install a boiler—one order to your local Crane Branch or Wholesaler covers everything. One responsibility for all materials—Crane—simplifies and speeds the job. Crane uniform quality assures the uniform dependability you want in all boiler lines.

Whether your needs be usual or unusual, Crane supplies them from the world's greatest selection. And what Crane can do to give you better power piping, it can also do for all piping systems in your plant.

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers
Serving All Industrial Areas

(*Right*) AT THE HEAD OF THE CLASS *for steam services — Crane 300-pound Alloy Steel Wedge Gate Valves. Supplied with Exelloy to No. 49 Nickel Alloy seating for steam, water, gas or air up to 850° F. maximum; with Stellite to Stellite, for steam up to 1000° F.; and with Exelloy to Exelloy, for oil and oil vapor up to 1100° F. Screwed, flanged, or welding ends. Your Crane Catalog gives complete specifications.*

CRANE
STEEL
300

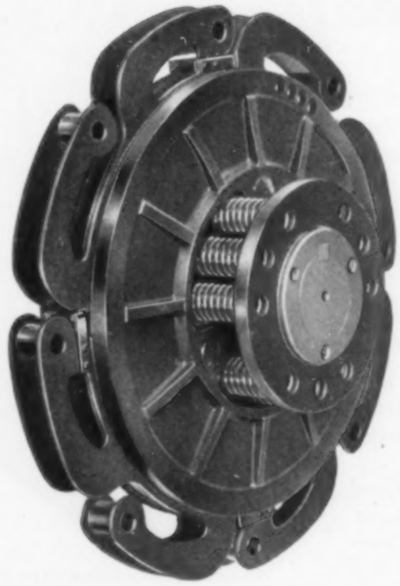
EVERYTHING FROM ...

CRANE

FOR EVERY PIPING SYSTEM

VALVES • FITTINGS
PIPE • PLUMBING
HEATING • PUMPS

AIR-POWER BUILDS AN AIRPORT ON ROCK....



This is the 13½" Double *Flex-Disc* Clutch used on all K-500 I-R Portables.

The grading down of a large rocky knoll and the putting in of drainage and conduits within a 300 day time limit for the Wilkes-Barre — Scranton Airport has brought together what is probably the greatest concentration of mobile air equipment ever assembled in one working area.

The blastholing for this construction is being done by 46 Ingersoll-Rand wagon drills plus 18 I-R Jackhammers. The air is supplied by several batteries of 500 cfm. I-R *Mobil-Air* Compressors equipped for trouble-free operation with *Flex-Disc* Clutches.

INDUSTRIAL CLUTCH CORPORATION

Waukesha Wisconsin

It's No Sacrifice to be Safe

WHEN GOGGLES ARE COMFORTABLE AND GOOD LOOKING

Workers like the comfort and appearance of AO Ful-Vue Safety Goggles. *You'll* like the efficient eye-protection they afford — with consequent reduction in costs; their unusual durability — for maximum economy.

Made in three eye and three bridge sizes; with 6 Curve Super Armorplate Clear or Calobar lenses — with or without side shields. Your nearest AO Safety Representative can supply you.

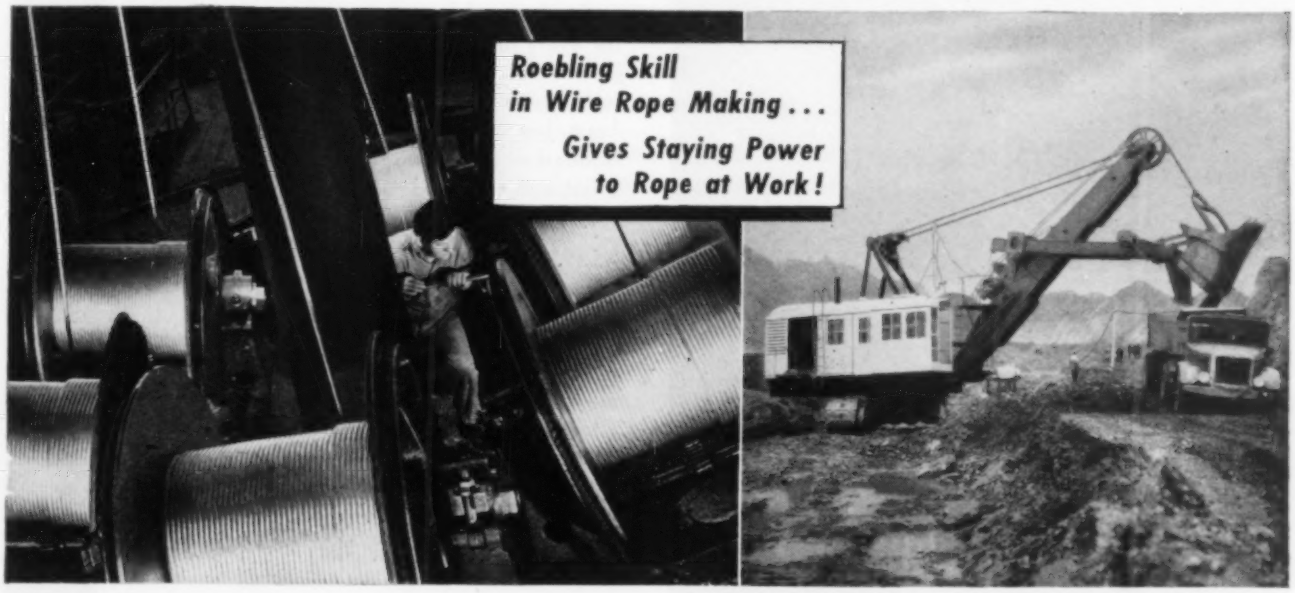
American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS
Safety Division
BRANCHES IN PRINCIPAL INDUSTRIAL CITIES

AO Safety Goggles Safeguard the Eyes of Industry—Reduce Production Costs

O.M.C. says:

(OLD MAN COMPETITION)

Keep production up—costs down—use the right wire rope!



Roebling Skill in Wire Rope Making...

Gives Staying Power to Rope at Work!

SUCCESSFUL BUSINESS OPERATION in the face of growing competition will force utmost economy from all industrial equipment and supplies. Production costs must be kept to a minimum.

Roebling wire rope can help do this job. It is economical because of its low average cost, its toughness, its reserve strength under *all* conditions of operation. It helps *save* while it *serves!*

The modern facilities and craftsmanship of America's first wire rope maker are unsurpassed. Constant research and practical engineering back every phase of Roebling operation. Vital factors like these make Roebling "Blue Center" Steel Wire Rope the choice to help you produce in volume . . . keep costs down . . . meet competition profitably.

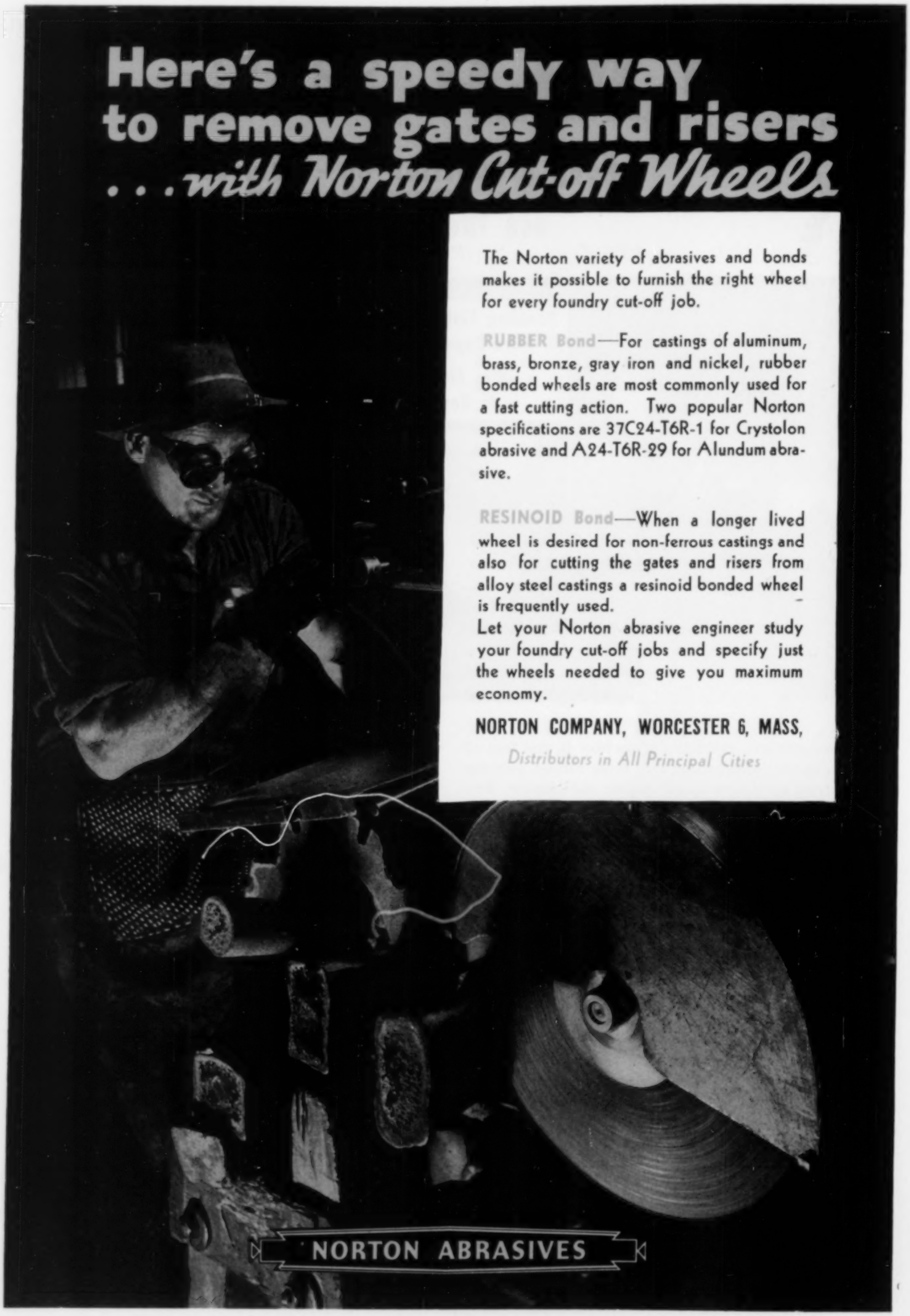
JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

WIRE ROPE AND STRAND • FITTINGS • SLINGS • SUSPENSION BRIDGES AND CABLES
COLD ROLLED STRIP • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS
AIRCORD, SWAGED TERMINALS AND ASSEMBLIES • AERIAL WIRE ROPE SYSTEMS • ROUND
AND SHAPED WIRE • ELECTRICAL WIRES AND CABLES WIRE CLOTH AND NETTING

ROEBLING
WIRE ROPE
TRENTON N.J.

ROEBLING

PACEMAKER IN WIRE PRODUCTS



Here's a speedy way to remove gates and risers

. . . *with Norton Cut-off Wheels*

The Norton variety of abrasives and bonds makes it possible to furnish the right wheel for every foundry cut-off job.

RUBBER Bond—For castings of aluminum, brass, bronze, gray iron and nickel, rubber bonded wheels are most commonly used for a fast cutting action. Two popular Norton specifications are 37C24-T6R-1 for Crystolon abrasive and A24-T6R-29 for Alundum abrasive.

RESINOID Bond—When a longer lived wheel is desired for non-ferrous castings and also for cutting the gates and risers from alloy steel castings a resinoid bonded wheel is frequently used.

Let your Norton abrasive engineer study your foundry cut-off jobs and specify just the wheels needed to give you maximum economy.

NORTON COMPANY, WORCESTER 6, MASS,

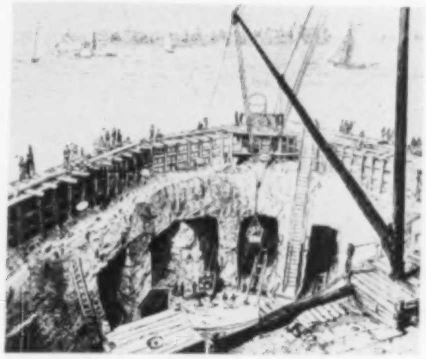
Distributors in All Principal Cities

NORTON ABRASIVES

ON THE COVER

TEN years after its completion, Boulder Dam remains one of the world's outstanding engineering accomplishments. During the early war years, the tenth generator was placed in its power plant to furnish additional electric energy for West Coast industries. Its capacity is now approximately 1,300,000 hp., or 70 percent of its ultimate projected output. Our cover picture shows the 727-foot-high concrete plug and appurtenant works, along with the lower reaches of Lake Mead, which extends 115 miles upstream. Photograph is from International News.

●



CORRECTION

THE picture above was published on page 62 of our March anniversary issue with the caption: "Building Hell Gate Bridge." Merrill M. Ross of Cleveland, Ohio, points out that this description is erroneous, although the location is correct. Actually, the picture shows a shaft that was excavated in connection with the removal of Hell Gate Reef, an underwater obstruction to navigation. This is apparent from the tunnels that may be seen opening out from the shaft. These were driven out into the rock in the channel and expanded into chambers that were loaded with powder and fired. Mr. Ross recalls that this work was still underway when he was a boy on the East Side of Manhattan Island, and he witnessed some of the later blasts. The illustration was made in 1887, at which time Hell Gate Bridge probably had not been thought of. That world-famed arch structure was opened in 1917.

●

ANOTHER misstatement in our March issue has been brought to our attention by G. W. Winslow of Pittsburgh, Pa. On page 77 of the article *Early Pneumatic Tools*, it was stated that "vane-type motors were introduced in comparatively recent years." Mr. Winslow writes: "I don't know when vane-type tools were first used, but I do know that they were listed in the Ingersoll-Sergeant literature of 1904. They were called 'rotary piston' drills."

Compressed Air Magazine

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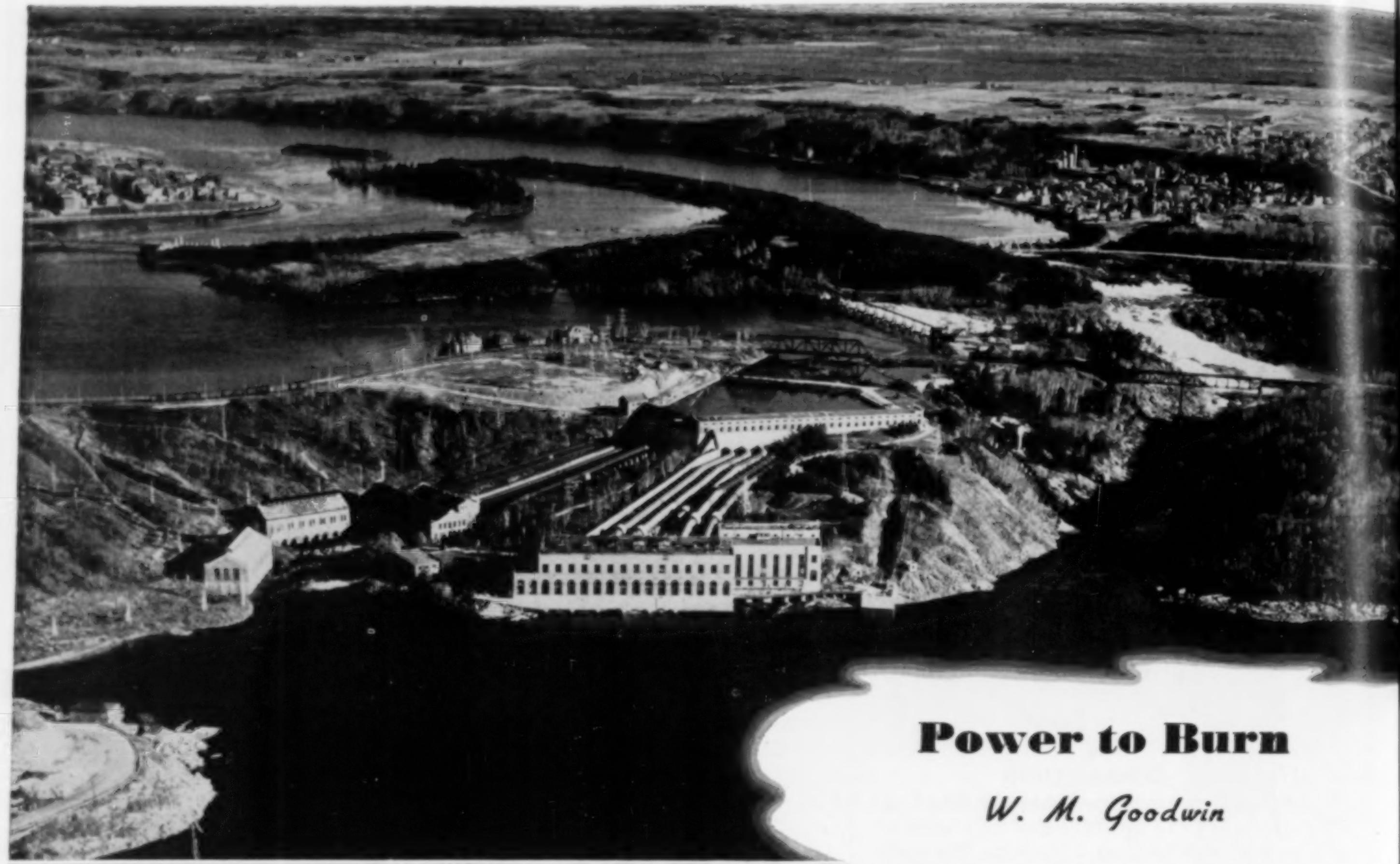
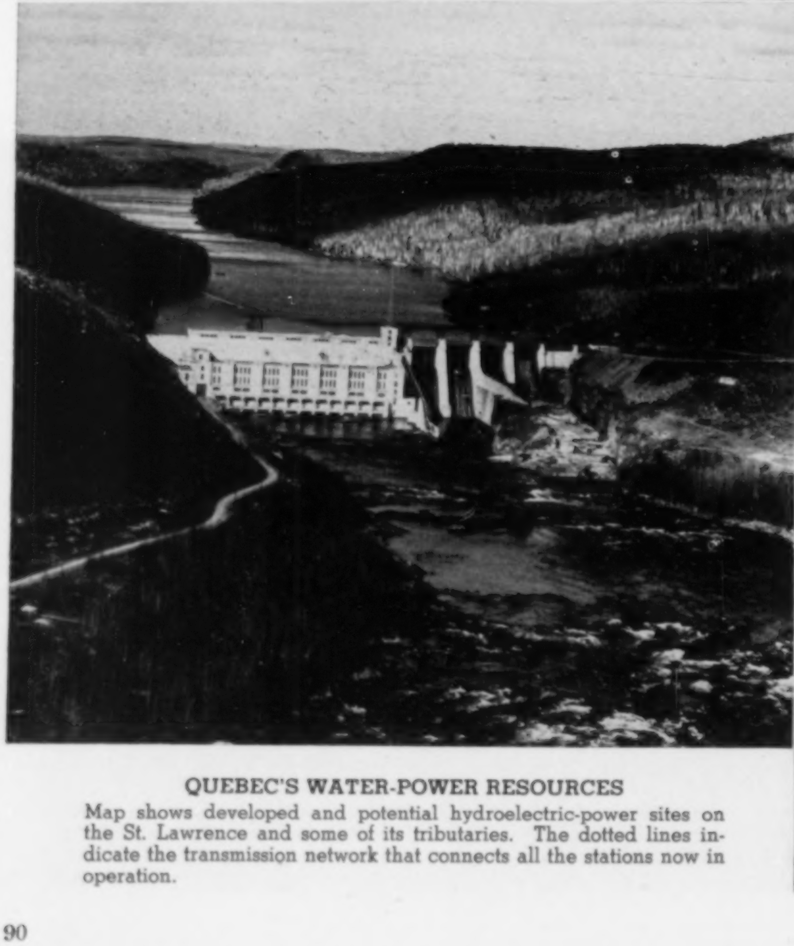
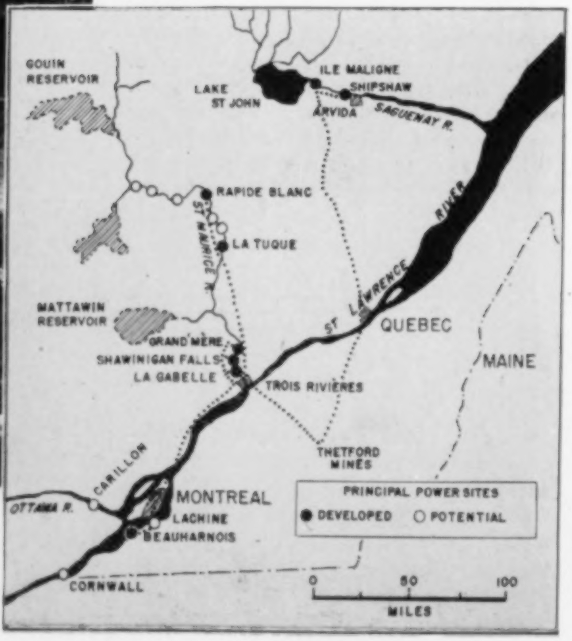


Power to Burn

W. M. Goodwin

THREE hundred years ago, when the fur trade was Canada's chief industry, her lakes and rivers were the only highways. Birch-bark canoes, singly or in "brigades," plied the waters that radiated from the St. Lawrence and brought to Montreal, Trois Rivières, and Quebec the pelts from half the continent. They formed wonderful canoe routes,

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ARVIDA
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RAPIDE BLANC
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LA TUQUE
MATTAWIN RESERVOIR
GRAND MERE
SHAWINIGAN FALLS
LA GABELLE
TROIS RIVIÈRES
ST LAWRENCE RIVER
QUEBEC
MAINE
THETFORD MINES
CARILLON
OTTAWA R.
MONTREAL
LACHINE
BEAUHARNOIS
CORNWALL
PRINCIPAL POWER SITES
● DEVELOPED
○ POTENTIAL
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QUEBEC'S WATER-POWER RESOURCES

Map shows developed and potential hydroelectric-power sites on the St. Lawrence and some of its tributaries. The dotted lines indicate the transmission network that connects all the stations now in operation.

ST. MAURICE RIVER POWER PLANTS

These pictures show three of the five St. Maurice generating stations, all of which are operated by the Shawinigan Water & Power Company. At the top of the opposite page is the 335,050-hp. plant at Shawinigan Falls. Below it is the most northerly of the developments, the 200,000-hp. powerhouse at Rapide Blanc, 140 miles north of the St. Lawrence. Above is a view of the 200,000-hp. plant at Grand Mere. Adjacent to the river, at the left, is the mill of the Laurentide Division of the Consolidated Paper Corporation, Ltd. A total of 1,130,000 hp. of electrical energy from these and other St. Maurice stations is distributed throughout most of southern Quebec to serve industrial and domestic consumers. When all sites are developed, the St. Maurice will provide 2,200,000 hp.

these lakes and streams, many of them so disposed that the portages were few and short and the voyageurs and fur traders could paddle for days on end with comparatively little interruption. Today it is perhaps hard to realize how important these traffic arteries were in those early times.

One river, however, which might have been a convenient route into the hinterland had an evil reputation. The St. Maurice, which joins the broad St. Lawrence through its final three channels at Trois Rivières, had so many falls and such a long succession of rapids that the traveler had to carry his canoe and its contents oftener and longer than he liked. Though its waters extended 200 miles northward, halfway in a direct line to Hudson Bay, the voyageurs bound for "The Bay" preferred a course almost double the length, via Timiskaming and Abitibi, that had much less portaging.

Now the falls and rapids of the St. Maurice have become one of the principal assets of the Province of Quebec. Though not a large river, as compared with the St. Lawrence, it is yielding 1,130,000 hp. of electrical energy. Five of its ten major power sites have been developed, and storage dams at the headwaters have almost trebled the natural minimum flow of its lower reaches by conserving a large measure of the surplus formerly wasted during the spring runoff. In the case of both power sites and storage dams, the natural advantages have permitted keeping down the capital cost so that St. Maurice energy is essentially low-cost energy.

The five sites still to be developed will provide an additional million horsepower, and as they are no less favorable than those already harnessed the cost of this power will be comparable to that now available. All are within 180 miles of the St. Lawrence, so that transmission should not involve an excessive outlay. Thus, when fully developed, the St. Maurice will be capable of generating more than two million horsepower of continuous electrical energy—in excess of the present production at Niagara Falls and as much as the full capacity of the St. Lawrence at Beauharnois. The total useful drop of the St. Maurice, comprising ten falls and rapids, is 1020 feet; that at Niagara (Chippewa) is 294 feet; and at Beauharnois, 85 feet.

It was that great South African, Field Marshal Smuts, who described the ideal conditions for water storage in the Dominion about as neatly as could be. He remarked to an eminent Canadian with whom he was traveling in Africa, "I envy you Canadians your rocks and your winters. Your rocks give you your lake basins, and your winters keep them filled up." The Great Lakes constitute vast natural storage basins that equalize the flow in the rivers draining them so that there is comparatively little variation during the year. In fact, the natural year-round supply for the Sault Ste. Marie, Niagara, and St. Lawrence hydroelectric works is so nearly uniform that little water need be wasted.

On many of the lesser streams are places where large quantities of water could be impounded by small and inexpensive dams. By building barriers such as these on the tributaries and at the headwaters of the St. Maurice, it has been possible to approximate the ideal conditions of flow that Nature provides in the Great Lakes. Thus the additional cost of supplementing intermittent hydroelectric power with stand-by steam plants is avoided. Numerous rivers in Ontario and Quebec generally offer much the same opportunities as does the St. Maurice for conserving the spring runoff. Therefore, even with full development of the power sites in the settled regions (now about 50 percent harnessed), the flow of the waterways can be maintained so as to produce firm power without the help of stand-bys.

The St. Maurice River provides the major portion of the electric energy used in the populated sections of Quebec. On the Saguenay, about 130 miles north of the St. Lawrence, an even larger block of power has been developed. This was primarily a wartime measure to furnish, at a minimum of expense and time, the means with which to manufacture some of the immense amount of aluminum that was required for airplane construction. Energy from the St. Maurice, on the other hand, has been utilized for ordinary industrial purposes, though it served to notable advantage in Quebec in making a wide range of munitions, as well as aluminum. Power is available from both sources at a low rate—one equalled by few other hydroelectric projects in the world.

On the St. Maurice, as on the Saguenay, primary industries—including pulp and paper, electrometallurgical, and electrochemical plants—normally consume most of the power generated there. It is expected that large blocks of electric energy will continue to be produced as required for the expansion of such basic industries. An outline of the principal low-cost power available in the lower St. Lawrence Valley will make this clear.

Present Development		Full Development
1,100,000 hp.	St. Maurice	2,200,000 hp.
700,000 "	Beauharnois	2,000,000 "
200,000 "	Saguenay	*1,000,000 "
2,000,000 "		5,200,000 "

These waterpower sources can provide a great amount of low-cost energy within a comparatively small area. Because of this fact, and despite only partial development, the region already has attracted a large number of the Canadian industries in which electric power constitutes an important item of the operating costs.

The Beauharnois site is favorably situated for the production of low-cost power on a large scale. When fully developed, the whole flow of the St. Lawrence will be diverted to it through a canal that has been dug and will need only further dredging. Now, with but one-third of the energy in use and with an appreciable percentage of the total cost of the whole undertaking charged against it, power from that source can be sold profitably at rates as low as any in Canada. When completely harnessed, it seems likely that the Beauharnois could provide current at even lower rates. It was taken over recently from the private owners by the Hydroelectric Commission of the Quebec Government, whose policy as regards future development has not yet been announced.

Some years before the war, when the aluminum plant at Arvida on the Saguenay was of comparatively small size and a substantial block of surplus power was available, The Shawinigan Water & Power Company, which owns and operates the St. Maurice project, built a 187,000-volt transmission line capable of feeding 200,000 hp. 135 miles southward into its system at Quebec City. When the American and British governments decided to obtain a large part of their increasing aluminum requirements from Arvida, this line was used in reverse, it carried current northward to the reduction works until power from the Shipshaw plant became available. Thus the St. Maurice hydroelectric stations helped substantially in the manufacture not only of vast quantities of munitions along the St. Lawrence but also of vital aluminum at Arvida. Today the line is again serving its original purpose, and additional ones could readily be constructed, if needed.

The Shipshaw power development of the Aluminum Company of Canada, located on the Saguenay, is at present the outstanding, single project of its kind in Canada. Many people are under the impression that the Saguenay district is in Quebec's hinterland. Actually it is as readily accessible as the banks of the St.

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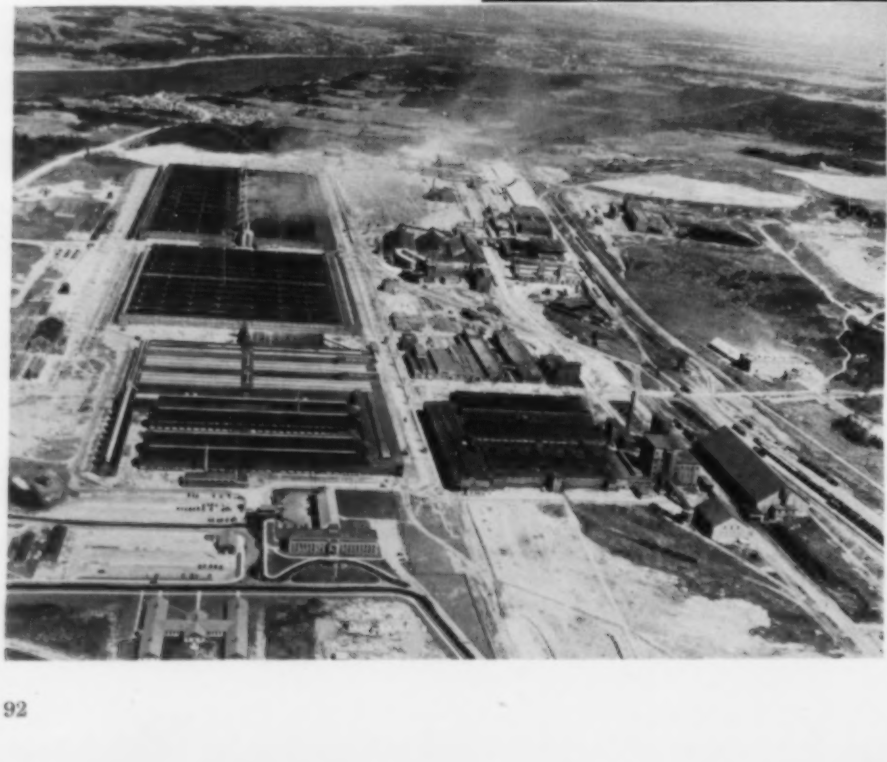
*Estimated. Dependent upon surplus available from the Saguenay and upon construction of additional transmission facilities.

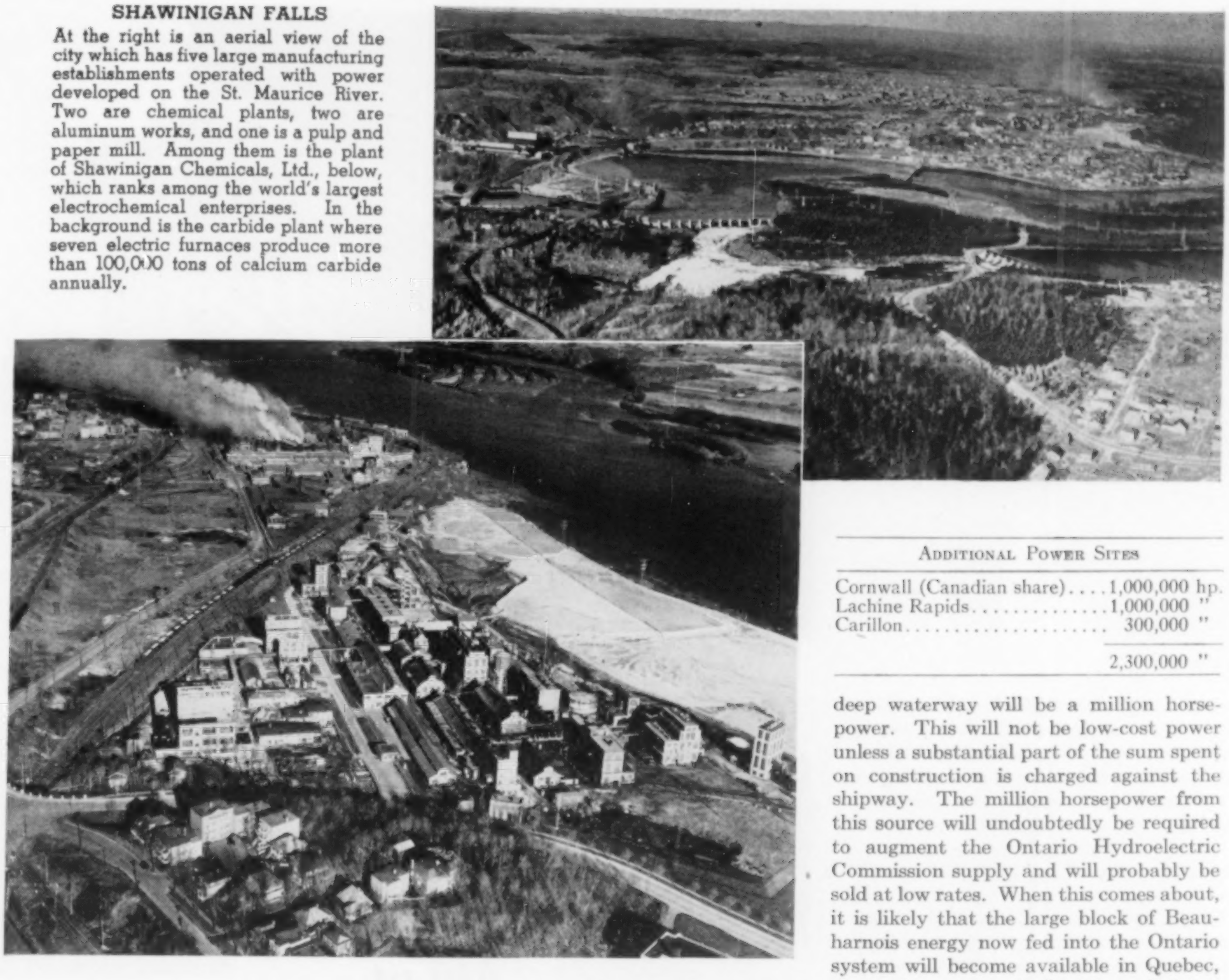


SHIPSHAW AND ARVIDA

Above is a view of the great Shipshaw development that was rushed to completion in secrecy during the war to provide additional power for making aluminum at Arvida. In the foreground is the principal plant, which contains twelve 85,000-hp. generators. Built in connection with the dam near the top is a 300,000-hp. station. The other picture shows the huge works of the Aluminum Company of Canada, Ltd., at Arvida. The ore plant is on the right. In the buildings at the left are the pot lines where the purified alumina is reduced to metal. The Saguenay River is in the background.

SHAWINIGAN FALLS

At the right is an aerial view of the city which has five large manufacturing establishments operated with power developed on the St. Maurice River. Two are chemical plants, two are aluminum works, and one is a pulp and paper mill. Among them is the plant of Shawinigan Chemicals, Ltd., below, which ranks among the world's largest electrochemical enterprises. In the background is the carbide plant where seven electric furnaces produce more than 100,000 tons of calcium carbide annually.



Additional Power Sites	
Cornwall (Canadian share)	1,000,000 hp.
Lachine Rapids	1,000,000 "
Carillon	300,000 "
	2,300,000 "

Lawrence. The area is well served by railway connections and by a deep-water harbor at Port Alfred, with docking facilities to accommodate the largest ocean freighters.

The Shipshaw hydroelectric system comprises two powerhouses with generating capacities of 1,200,000 hp. and 300,000 hp., respectively, and a third plant 30 miles upstream that can produce 540,000 hp. Almost all of this immense amount of electric energy was required until the end of the war for the manufacture of aluminum and related materials. Now, a large percentage of it is available for the making of other basic products in which power is an important part of the cost. Set in the midst of a thriving agricultural community, the district seems destined to retain its position as one of Canada's great metallurgical centers.

At this point it is worth interjecting an item that illustrates the reliability of the huge, modern generating units that provide all this energy. In the middle of the war period an American official, visiting the local Canadian power authorities, inquired as to the capacity of the stand-bys with which every well-established powerhouse is equipped. "We have no stand-by units," was the reply. "They are all in constant use." By putting all the generators in the St. Lawrence valley to work and by cutting nonessential civilian consumption to a minimum, extra pot lines for aluminum were installed in half a dozen convenient localities, huge explosives plants were operated, and munitions production in general was raised to a level that was considered well-nigh impossible until the need became so pressing. And even with no stand-bys to fall back upon, there was no interruption in service while the war lasted. Surely this is a record of which the designers and builders of the generating units may well be proud.

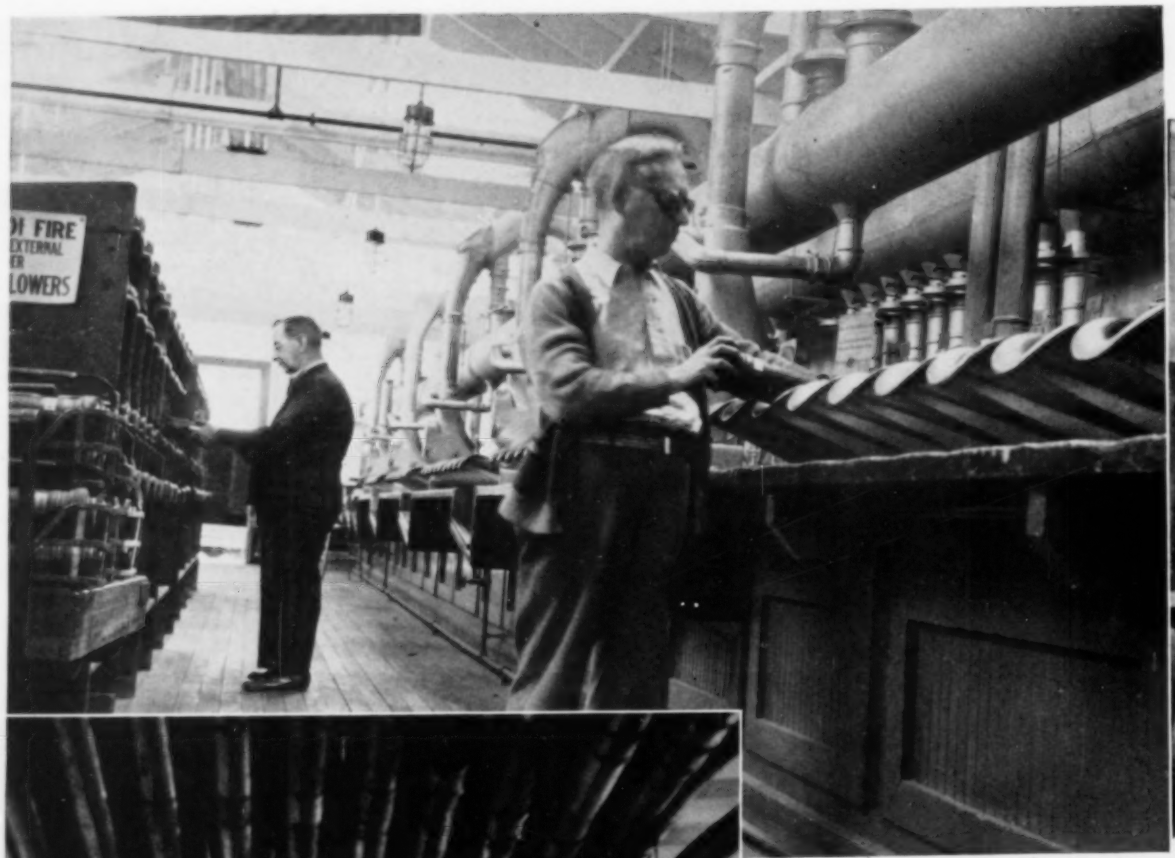
In addition to the low-cost power sites discussed there are three others of major size that are listed above and will probably be made available ultimately. One is actually within the metropolitan area of Montreal, and the two others are located almost as conveniently, but none can be developed cheaply for electric energy alone. However, two of them may furnish low-cost power in conjunction with the St. Lawrence deep waterway.

Canada's half of the energy to be obtained on the upper St. Lawrence at Cornwall in connection with the proposed deep waterway will be a million horsepower. This will not be low-cost power unless a substantial part of the sum spent on construction is charged against the shipway. The million horsepower from this source will undoubtedly be required to augment the Ontario Hydroelectric Commission supply and will probably be sold at low rates. When this comes about, it is likely that the large block of Beauharnois energy now fed into the Ontario system will become available in Quebec, also at low rates. At Lachine, adjoining Montreal, another million horsepower can be harnessed. As a power development it would not be economical; but as a by-product of canal building the charge for electric energy could be put at a low figure.

Among the lesser waterpower sites in this favored region is Carillon at a point on the Ottawa River near its junction with the St. Lawrence. As it does not lend itself particularly well to low-cost construction, and as there will be no deep waterway to share the expense, it will no doubt remain in reserve for a long time, together with a number of other sources of similar capacity on the north shore of the Gulf of St. Lawrence below the city of Quebec.

From the foregoing recital it is obvious that there is available today along the lower St. Lawrence and on the Saguenay a substantial surplus of power at exceptionally low rates for the manufacture of electrochemical and electrometallurgical products. With a vast amount of low-cost energy still to be developed, there is every likelihood that this condition will persist for years to come.

This is the first of a series of articles by Mr. Goodwin on power developments in Quebec. The second article will be published in our May issue.


FIRE
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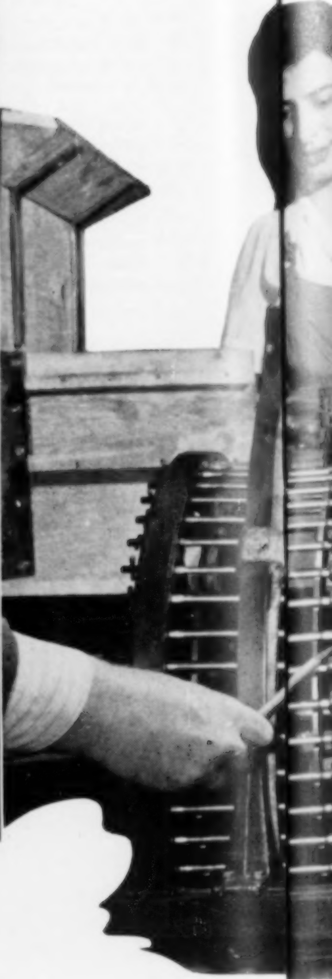
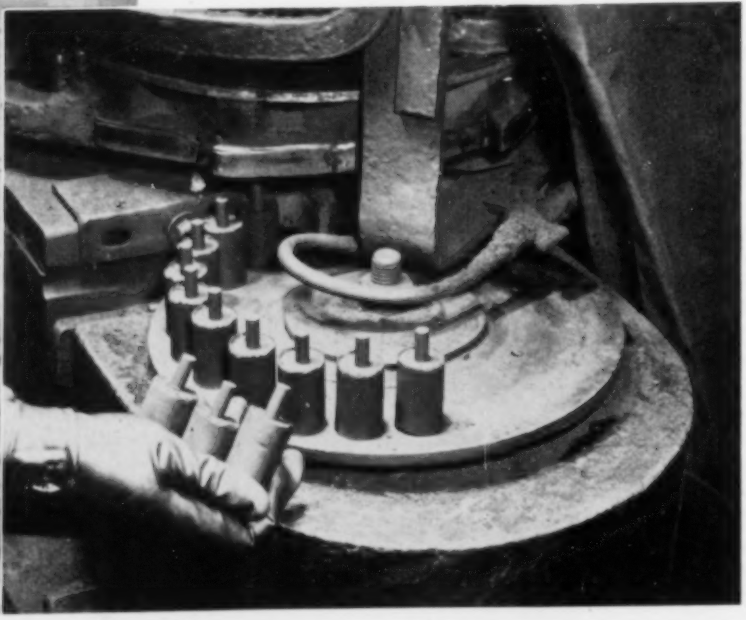
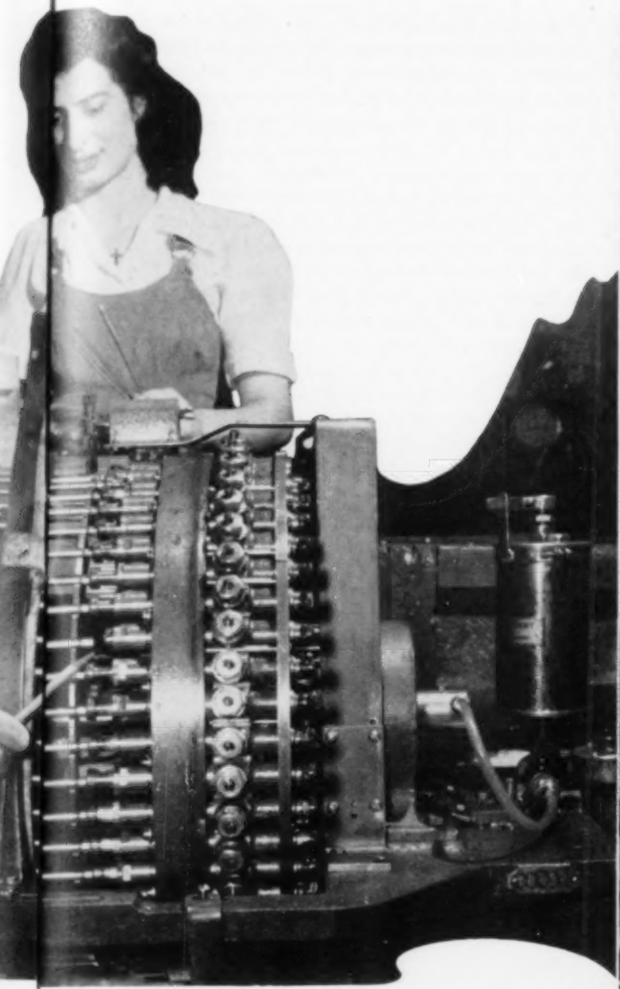
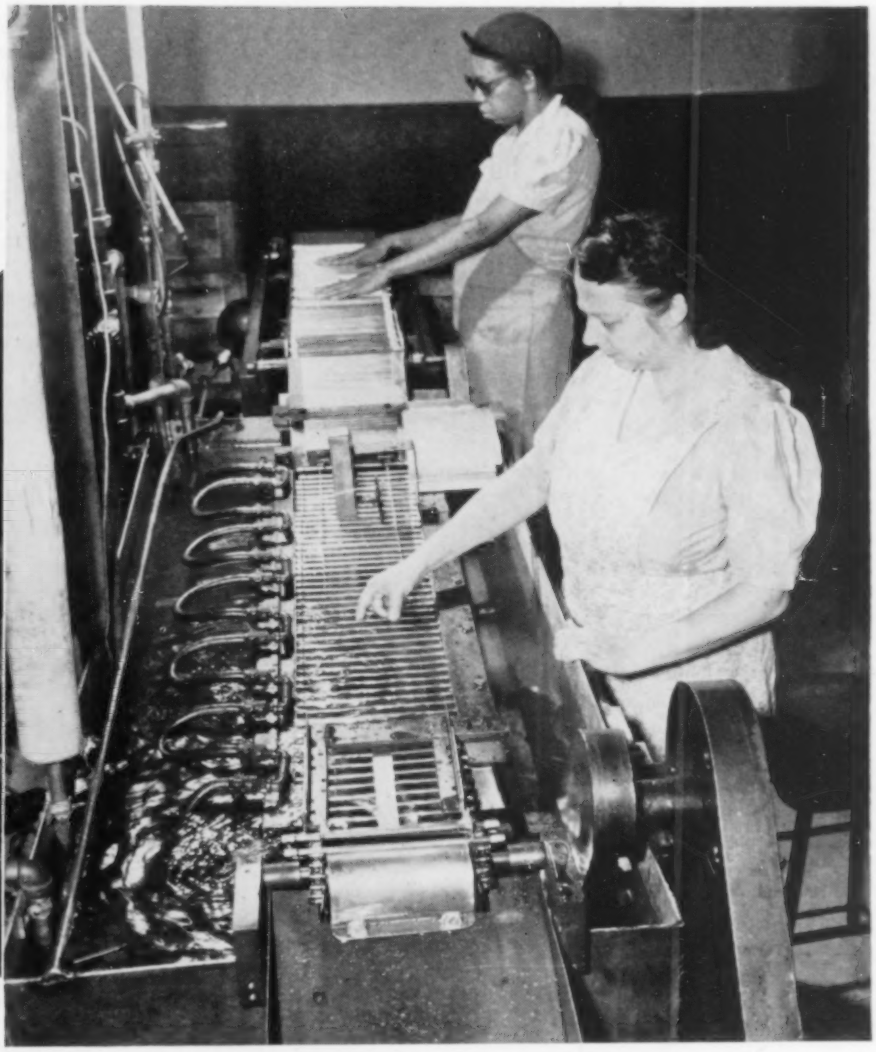


Compressed Air at Winchester Arms







SOME USES OF COMPRESSED AIR

Smokeless powder is moved about the plant quickly and safely in pneumatic tubes. Containers are dispatched from the mixing room (upper-left) to receiving stations in various cartridge-loading departments. A bank of pneumatic-tube lines is shown at the extreme lower-left. Winchester makes cartridge core radiators for buses and trucks, and during the war they were used on Army fighter planes having liquid-cooled engines. Tubes for these radiators are tested with air in one of two ways. On a revolving drum-type machine (center) they are held in place by pneumatic plungers through which air is introduced into them. If one tube leaks, the plunger holding it is retracted (indicated by pencil), causing it to fall out by gravity. Tubes that pass this automatic inspection are released when the drum has completed its revolution. In another set-up (above) the tubes are carried underwater by a conveyor while charged with air. Defective ones emit bubbles and are rejected. In making the core of a Winchester flashlight battery, depolarizing material is tamped around a carbon rod in the air-operated machine shown below the article heading.

FOR THE first time since 1941, America's ardent sportsmen—hunters, target shooters, and trap- and skeet-shooting enthusiasts—can look forward hopefully to a measure of enjoyment of their favorite pastime. While the fall of 1946 will still find dealers' shelves understocked with ammunition, rifles, and shotguns, there will be greater quantities available than at any time during the war period.

So depleted are stocks at present that such a well-established firm as the Winchester Repeating Arms Company Division of Olin Industries, Inc., New Haven, Conn., is of the opinion that, even though it has achieved peacetime production in many of its lines, it will take twelve to fifteen months to supply its distributors with the complete assortment of sporting rifles, shotguns, and aummunition they desire in quantity. In addition, the company makes such varied products as flashlights and flashlight batteries, commercial brass and brass specialties, roller skates, and cartridge core radiators and tubes.

The plant has been identified with the manufacture of arms and ammunition since the establishment of the firm by Oliver F. Winchester in 1866. The first rifle produced was named after the year of the company's founding. It was an improvement upon an older type designed by one of the concern's employees, B. Tyler Henry, who also developed the rimfire cartridge which helped to make the repeating lever-action Model 1866 a commercial success. Winchester recognizes Henry's achievement to this day with an "H" that appears on the head of all its 22 rim-fire cartridges.

With the sale of many thousand Model 1866's and ammunition to the Turkish government in the 1870's, the company entered the international field, and since that time the big red "W" has become a familiar mark wherever there is a demand for firearms and ammunition the world over.

Winchester's reputation became firmly established with the introduction of its second rifle, the lever-action repeater Model 1873. This gun became a favorite with western settlers in shooting game and in defense against the Indians, and is credited with having been an important factor in the winning of the West. Its new and heavier ammunition—the Winchester center-fire 44 cartridge, more familiarly known as the "44-40"—increased the weapon's effectiveness in the hands of such men as Buffalo Bill and other well-known pioneer characters.

Other lever-action repeating rifles and a slide-action repeating shotgun were brought out during the 1890 period. The first was the Model 1892, of which more than a million were made. Next came the Model 1894, the first American sporting rifle to use the first American smokeless-powder ammunition—the "30-30"—also developed by Winchester and generally accepted as the world's most widely distributed cartridge. The popularity of this weapon and cartridge continue unabated today, 52 years after their introduction. The "94" is looked upon as the favorite deer rifle in the United States, and the millionth one was presented to President Calvin Coolidge. This famous gun was one of the first to be put into manufacture after the plant's reconversion following V-J Day.

Winchester's first successful slide-action repeating shotgun was introduced to the American public in 1897, and was named after that year. Its popularity with hunters and trap and skeet shooters has been maintained for almost half a century, and now, back in peacetime production, it is nearing its millionth mark.

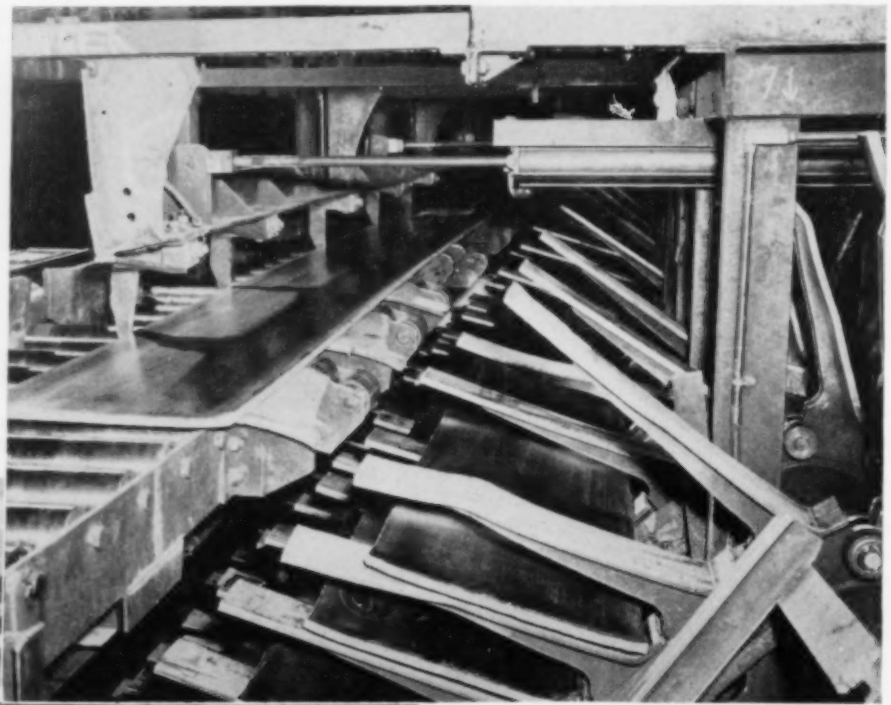
New and improved firearms continued to make their appearance after the turn of the century, and in 1912 the company put out its first hammerless slide-action repeating shotgun—the Model 12. This weapon steadily increased in popularity, and the millionth one manufactured was presented to Gen. H. H. Arnold while Chief of the Army Air Forces. Thousands of Model 12's were used to train aerial gunners during the recent conflict.

All of Winchester's facilities were given over wholly to the production of war materials at the start of World War I, and by the end of hostilities the company had turned out in excess of 500,000 caliber-30 service rifles and bayonets; nearly 50,000 Browning light machine guns; more than a half billion caliber-30 service cartridges; and about 500,000 primers, caps, tracer cartridges and components, high-pressure cartridges, and dummy cartridges.

Return to peacetime operation was marked by the introduction in 1920 of Model 52, a bolt-action target rifle of such accuracy that it made small-bore shooting the most popular form of competitive marksmanship. This gun is again in production and has frequently won every small-bore trophy in matches in the United States.

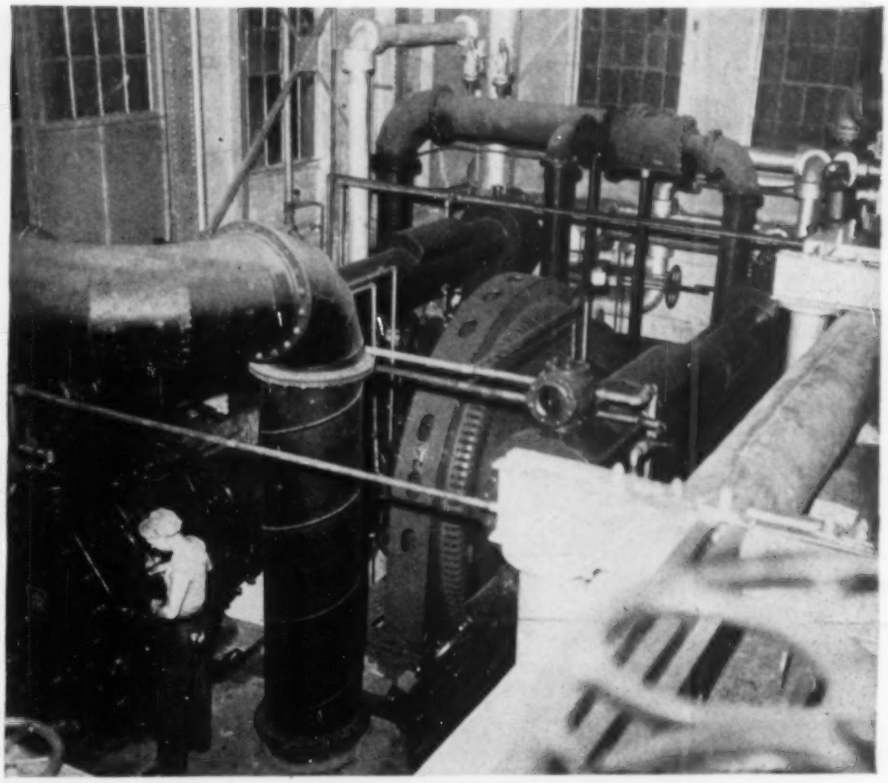
The company's first double-barrel shotgun, Model 21, made its appearance in 1930 and has received wide acceptance. In addition to a number of caliber-22 rifle models manufactured prior to World War II, Winchester placed an outstanding hunting rifle on the market in 1936, calling it the Model 70. It is available chambered for any one of ten cartridges, ranging from the world's fastest commercial bullet, the 220 Swift, to the 375 Holland and Holland Magnum, largest cartridge made in the United States.

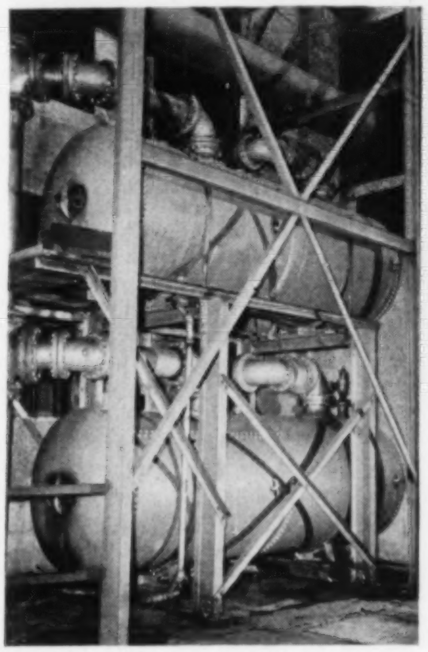
Once again, from the beginning of World War II, the company devoted itself practically 100 percent to war production. Its engineers designed the Winchester carbine, and the factory built close to a million which, before the end of the conflict, saw action on every American fighting front. The company was the only commercial gun producer in the country to manufacture the complicated Garand rifle, turning out more than 500,000 of these weapons, together with quantities of other war materials such as metallic cartridges and shot-shells, flashlight batteries for the U. S. Signal Corps,



TRANSFER CONVEYOR

The brass mill uses more compressed air than any other department of the plant. These pictures show one of the paddle conveyors that transfer brass sheets on to and from roller conveyors that carry them through a rolling mill. In the view above, a 1350-pound sheet at the left is about to be pulled off the rollers by the action of the overhead horizontal air cylinder. The sheet will be slid onto the arms of the paddle conveyor at the right, which will place it on another roller conveyor at a lower level preparatory to routing it through the rolling mill for another pass. At the left in the lower view of a section of the paddle conveyor is the air cylinder that operates it.





COMPRESSED-AIR SUPPLY

The largest of the four air compressors in the plant is shown at the right. It is a "4-corner" Ingersoll-Rand unit with a compression cylinder at each end of the dual frame. The centrally situated 1000-hp. synchronous motor operates the machine, which delivers 6200 cfm. of air. Below are pictured two large receivers into which the air from all the compressors is directed after first passing through an aftercooler for extraction of oil and water vapors. From there it is fed to storage receivers, whence it is transmitted to the various departments through 6- and 3-inch mains.

and cartridge core radiators and radiator tubes for fighter planes.

As compressed air plays an important part in the making of every Winchester product the company has four air compressors—three steam-driven and one motor-driven. The latter, which was installed in 1941, has a capacity of 6200 cfm. and is operated by a 1000-hp. synchronous motor. It is an Ingersoll-Rand Class PRE machine of 4-corner construction—that is, it has a compression cylinder at each end of its dual frame, with the driving motor located centrally between. Two are low-pressure cylinders of 30-inch diameter and the other two are high-pressure cylinders of 18-inch diameter. All are of 21-inch stroke. Each of the steam-driven units has a capacity of 1500 cfm., making a total compressor capacity of 10,700 cfm.

Air is compressed to 100 pounds per square inch and goes from the machines through an Ingersoll-Rand aftercooler and thence through a 14-inch header to two large receivers, each 16 feet long and 5 feet in diameter. Five additional receivers at different points throughout the plant provide large storage capacity and help to maintain steady pressure. The air is distributed to the various departments by 6- and 3-inch mains. A unique feature of the set-up enables maintenance or construction crews to connect air hose to main lines anywhere throughout the factory, thus eliminating the need of portable compressors. The present air consumption is approximately 80,000,000 cubic feet per month.

The brass mill is the largest single user of compressed air. There, by an ingenious combination of roll and paddle conveyors, 1350-pound brass bars are moved and transferred in passing them through a 2-high breaking-down mill. As received from the casting shop, each bar is about 7½ feet long and 2½ inches thick. After ten "passes" through the mill it emerges as sheet material, 40 feet long and approximately ½ inch thick.

The conveyor system consists of two power-driven roll conveyors which travel on different levels and carry the bars into and out of the 2-high mill back to the feed end, and of two air-operated paddle conveyors which serve as transfer units. After a pass, one of the latter moves the stock from the upper on to the lower roll conveyor, which is underneath the mill, while the second paddle conveyor receives the stock from the bottom roller conveyor, raises it, and places it on the top one for another pass through the mill. Transfer of the bars or sheets is effected by twelve "kickers" operated by pneumatic cylinders.

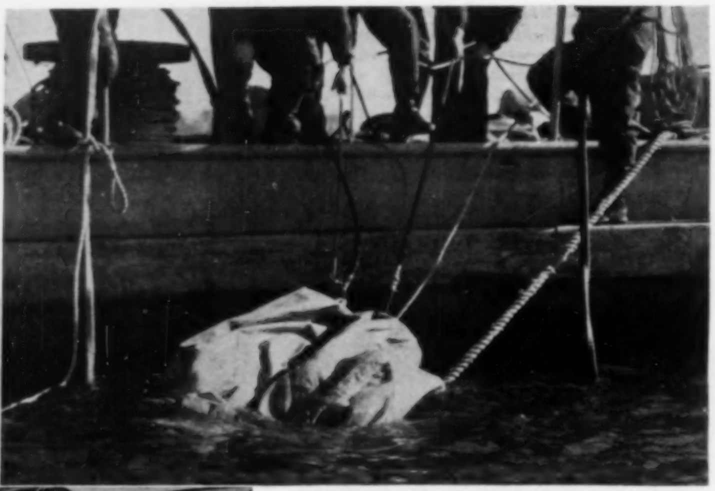
The paddle conveyors are made up of a series of eight iron arms, each 3 feet long and about 6 inches wide, arranged in parallel, lengthwise rows which are attached to roller chains traveling in iron tracks. Each conveyor is operated by a large Hopkins double-acting pneumatic cylinder. It is 14 inches in diameter, has a 35-inch stroke, and is controlled by two speed-regulating valves and a solenoid valve. As the stock is moved on to or off the paddles by the kickers, a heavy iron bar secured to the piston of the Hopkins cylinder brings an empty row of arms into place. When fully loaded, each paddle conveyor carries between 14 and 15 tons of brass, which gives an idea of the great weight the big pneumatic cylinder has to carry.

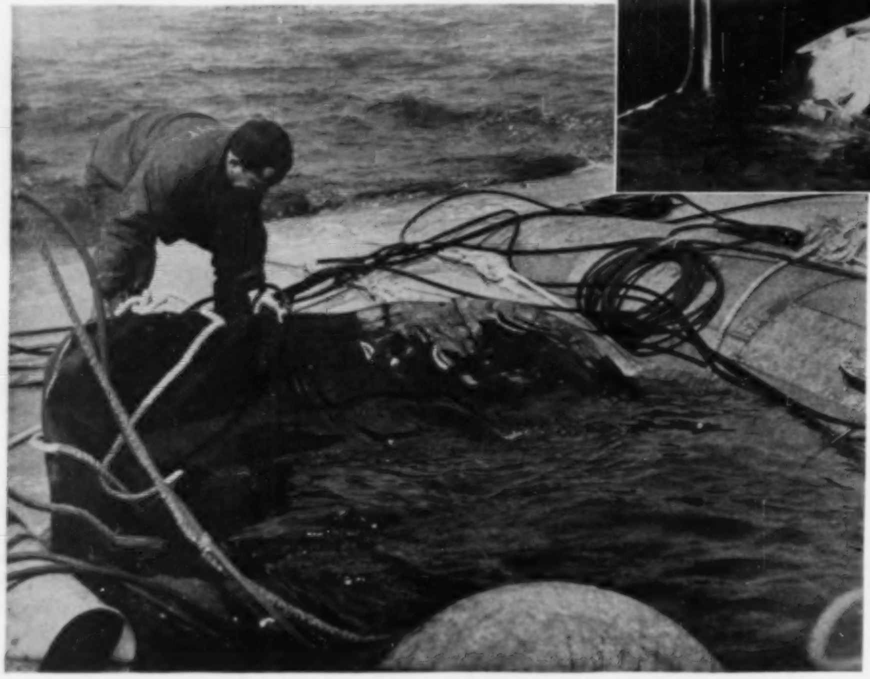
Every department in the plant has numerous air outlets to facilitate blowing scrap material from machines and also to keep equipment clean. A good example is the wood-working shop, where sawdust and chips accumulate rapidly during a day's work. The latter also requires air for spraying lacquer on gunstocks. Gun barrels, which undergo many varied operations, necessitate cleaning by blowing them out with air. Polishing machines, drawing presses, and hydraulic presses in the cartridge department, as well as bullet-trimming machines, use considerable air.

Then there is the battery shop which also needs large amounts of air in connection with the tamping machines which make cores for flashlight batteries and for blowtorches. And the cartridge core radiator department has application for it in testing radiator tubes and on extrusion presses. In addition, compressed air performs miscellaneous other services such as actuating hoists, electric doors, and hydraulic cabbaging machines; ramming electric furnaces in the brass casting shop; and operating grease guns generally throughout the plant.

Pontoons for Raising Sunken Airplanes

U. S. Navy Photos





SALVAGE OPERATIONS

At the top is a collapsed pontoon, showing attached air hose for its inflation. At either side of the bag are wrapped air lines and life lines extending to divers at work underwater on a sunken airplane. In the other picture a salvor is seen at work on a plane that has been refloated.

AVIATION and marine salvage have joined efforts in a novel way in the U. S. Navy. The Ship Salvage Branch of the Bureau of Ships and the Aircraft Maintenance Branch of the Bureau of Aeronautics, both of the Navy Department, have been collaborating for some while in designing and experimenting with collapsible pontoons intended primarily to aid in recovering sunken naval aircraft. The pontoons have the outward appearance of globular balloons of varying sizes and are capable, when submerged and filled with compressed air, of exerting a buoyant impulse of considerable moment. There are many good reasons for the development of these salvage aids.

Airplanes are relatively fragile structures that must be handled carefully when lifting them from the surface of the water to the deck of a carrier, for instance; and the raising of a sunken seaplane is an even more ticklish job, especially if it is in a crippled condition and has to be brought up to the surface in a wind-swept area where the seaway may give the rescue vessel a rolling or pitching motion.

Naval craft of widely differing types, sizes, and dead weights have been used in great numbers in recent years, and many of them have "crashed" on to the water and gone to the bottom. Means for the recovery of the wrecks have been devised and utilized where the depth did not make the work prohibitive; but the responsible naval authorities have sought special equipment that would meet the particular needs of the service. Salvage "balloons" or cells of a collapsible type are the present answer.

In principle, collapsible pontoons are not a novelty. In the past they have been successfully employed in raising sunken ships ranging in dead weight from 179 to 607 tons. Those pontoons were either simple "air bags" or cylindrical, inflated bodies constructed of canvas or an India-rubber fabric of the necessary strength. The largest of the latter type, according to available records, was approximately 26 feet long and slightly more than 10 feet in diameter. When expanded, it had a lifting capacity of 50 tons. It was made of strong waterproof canvas and was covered with a rope netting to reinforce it against internal pressure and also to protect it from damage when rubbing against the hull of a vessel during salvaging. When deflated, collapsible pontoons can be folded up for easy stowage or for better handling when placing them inside a flooded or submerged boat to exert a measurable amount of buoyancy to supplement any external agencies used during the final lifting operations.

The larger of the pontoons heretofore utilized by British and other European marine salvors have been provided with valves through which compressed air could be forced into them to inflate them, as well as with automatic relief valves that would permit the air to escape progressively as the pressure of the external water decreased as the balloons floated surfaceward. This was done, of course, to prevent the confined air from becoming a bursting force. The Navy's new collapsible pontoons have been designed by men familiar with the earlier types. They represent a marked advance, and are especially fitted for the work of salvaging seaplanes.

The submergible pontoons that serve the Navy in recovering sunken submarines, for example, are great steel cylinders sheathed with timber to protect them from damage during their rugged service in open waters and perhaps in rough seas. Even at the surface they are difficult to handle because of their weight and sometimes unpredictable movements, and they are often very hard to control when filling with water ballast and while sinking. Before the salvors get them on the water bed and properly located there the structures may even damage the boat they are to help raise. For the recovery of airplanes it was therefore necessary to develop a form of pontoon that could be restrained going down and coming up and that would be far less likely to imperil or injure the submerged craft.

The Navy's new globular pontoons are lowered in a deflated state and can be moved about by the divers and readily secured to the wreck just where needed. When suitably arranged at their designed stations they can be filled with compressed air and given the exact buoyancy required to break contact with the water bed and to float surfaceward with their load. Up to date only a limited number of these salvage facilities have been made available for the double purpose of facilitating the training of special crews and to point the way for further development. Their major test so far has been that of raising a big 4-engined seaplane weighing approximately 30 tons. The craft lay at a depth of 100 feet offshore from the naval air station on the Patuxent River in Maryland.

Up to the present time, the balloonlike pontoons have ranged in diameter from 5 to 7 feet, and their unit maximum buoyancy has been 2 and 5 tons, respectively, not including the weight of the harness or lifting rigging and envelope. The latter is made of a strong rubber-impregnated fabric that is both water repellent and airtight and capable of withstanding either the air or the water pressure to which it may be subjected in service.

The most critical period of action is when a pontoon has been fully inflated at any given depth and is floating toward the surface bearing its proportionate share of the load. Throughout the entire journey upward, the pressure of the contained air has to be reduced automatically so as to exceed only slightly the decreasing pressure of the surrounding water. This adjustment is maintained automatically and halts, of course, should the pontoon pause in its ascent. The valve controlling the release of the compressed air has been designed by the naval men and been progressively improved so as to respond certainly and promptly to the changing hydrostatic pressure. Otherwise the overbalancing air pressure could become excessive enough to rupture the envelope.

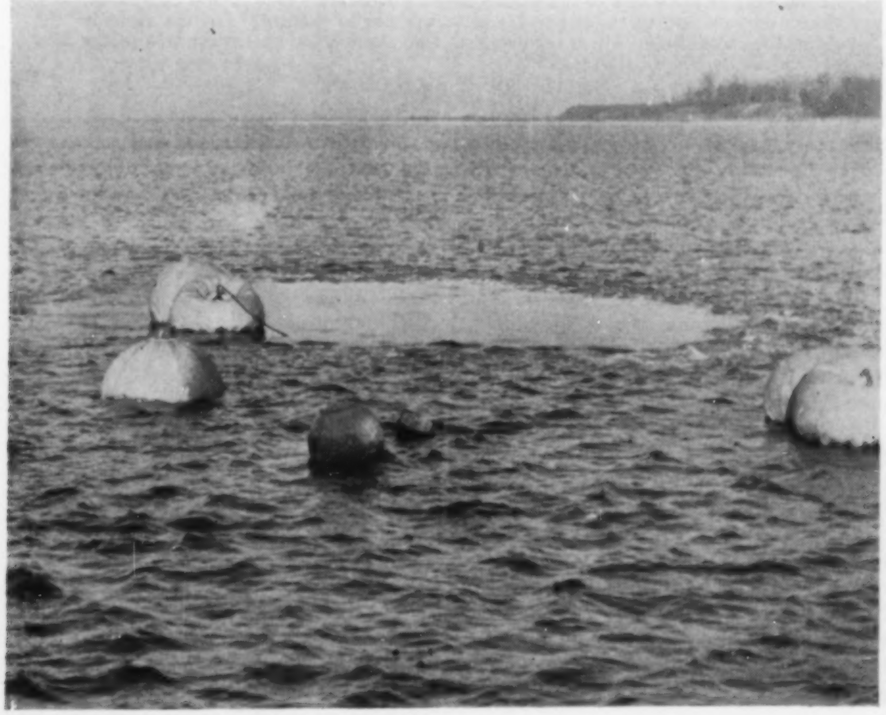
In the earlier stages of the development of these collapsible pontoons the compressors utilized were of greater output and much heavier than the units that now supply the air and presented handling difficulties aboard the small craft assigned to serve as floating bases for the wrecking operations. Those now in use are much smaller and, as they weigh only a few hundred pounds, can be shifted about manually. They add considerably to the speed and facility with which the work can be carried on. The air hose for each balloon leads directly from a service station aboard the salvage boat. It is attached to the envelope at the top, and at that point there is a valve that the diver on the job can open or close to admit air to the pontoon when first inflated or to close the line, if necessary.

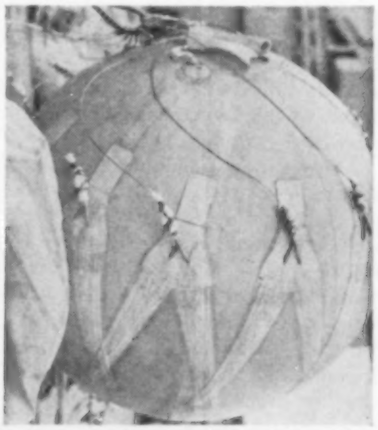
The load is taken up by each pontoon through light wire cables that are symmetrically secured to rope "eyes" or loops bound to fabric patches and further held in place by V-like overlapping fabric arms that distribute the stresses over a wide surface. The loops are arranged at short intervals around the pontoon just below its equator, and the pendent shrouds are drawn together below. There they are attached, in turn, to the eye of a larger cable that takes the direct lift of the wrecked aircraft. Some of the later and larger of these pontoons are equipped with a cloak or net of wire mesh of considerable size that serves to reinforce the fabric envelope when under pressure and also as a measurable defense against damage by angular parts of a plane's structure.

Aboard the salvage boat the compressor delivers to a manifold from which air lines lead to the various balloons, and gauges at that control station indicate the condition of each pontoon by registering the volume of air fed to it. In this manner the air supply can be regulated so as to apply to the wreck at each sustaining point just the right amount to keep it balanced during its ascent. Likewise, in an emergency, such as might arise in case of a rapidly approaching squall, it would be possible to release air from the pontoons through their supply lines so that the wreck could again settle to the bottom until the surface of the water was quiet enough to refloat it and move it to a haven.

Although designed to deal only with seaplanes, these salvage facilities may prove so valuable and effective that similar pontoons of much larger size may be constructed to raise craft of differing types and greater weight. As part of the present program, the Navy is making use of a new and lighter suit for divers engaged in the recovery of sunken aircraft. This suit has a number of advantages over those heretofore employed in the work and may also serve the diving experts of our fighting fleet in other departments of their activities.

In the Bureau of Ships, Capt. B. E. Manseau, USN., is in charge of the Ship Salvage Branch, with diving operations directed by Lieut. A. W Mott, USN. In the Bureau of Aeronautics, Capt. E. W. Claxton, USN., heads the Maintenance Division and Lieut. Commander H. T. Bogle, USN., is in charge of the development of special equipment, including the collapsible pontoons.





INFLATED AIR BAGS

Partly and fully inflated pontoons (left) over a sunken plane, with a marker buoy in the foreground. Above is a close-up of one type showing the shrouds and rope loops by which the small, steel lifting cables are attached. The shrouds are drawn together below and attached to a larger cable that takes the direct load of the wreck.

頂好

("Ding Hao"—Excellent)

*E. K. Smith**

PERSONNEL

At the top-left are a few of the young foundry workers. One of the competent young engineering-school graduates is in the center picture. On the right is the smiling interpreter Mr. Kuang-Ta Wu, who assured the author that the laborers were older than they looked.

LATE in 1944, urgent orders came through: "Make many more trench-mortar shells." The Japs were threatening what was left of Free China from almost every direction. In fighting a delaying action, the Chinese army had no heavy artillery, and very few light field guns. Except for the support of the U. S. Air Forces things would have been much worse. However, the Chinese arsenals could, and did, make trench mortars from anything, and at that time trench mortars and land mines offered the most effective form of defense.

The big hitch was that there were not nearly enough trench-mortar shells and land mines to supply the army adequately. The arsenals, under the able leadership of the Chief of Ordnance, Lieut. Gen. Yu-Ta-wei, were running to capacity and casting shells by the thousands, but not nearly enough to stop the Japanese, who were advancing rapidly. In most plants, each department was in a separate building so that enemy bombs could not wipe out the whole establishment at once. Besides this precaution, some of the most important divisions were housed underground where they were safe from aerial attack.

A big foundry company at Kunming had ample capacity but no orders for shells. It was during this critical period that the Chinese War Production Board was formed under the driving force of Donald Nelson and with the brilliant Minister of Economic Affairs, Dr. Wong-Wen-hao, as director. Then things really happened. The plant received a large order for trench-mortar shells. In the United States the acceptance of such a new order would have been accompanied by some delay, incident to making suitable patterns, procuring materials, and actually getting production underway. But in China there was little to start with—no experience, almost no raw materials, and mostly crude equipment. However, there was desperate need, a great number of willing workers, and technical advice from the excellent Nelson Mission. (The author had been working in the Chinese Government foundries on war production at the request of that government but under the auspices of the U. S. Department of State.)

Difficulties were many, some serious, some almost ludicrous. One of the biggest troubles was the inflation, which was getting worse and worse. There was no metal currency, and the value of the paper money decreased daily. In America, the thought of a Chinese $100 bill being worth ten cents in U. S. currency arouses amusement, but in China it was a matter of life and death. It was tough on the laborers, so many foundries paid the men partly in rice, which helped a lot. But the "white-collar" men received fixed salaries, and each pay day the salary would buy less food. On one occasion the author noticed a stack of something in the rear of a company car, and upon investigation found that it was baled bills to meet a pay roll! (Uncontrolled inflation certainly bears out what General Sherman of Civil War days had to say about war.)

Of course it was hard to get raw materials, especially with the value of the currency sinking continually, but pig iron was bought with the help of the government. This was not as easy as it might seem. There were no railroads, and highways were none too good, except those built by the U. S. Army. They were a joy. New trucks could not be obtained at any price, but old trucks imported from America many years ago were still rolling. After gasoline had given out, alcohol was substituted, and when alcohol was no longer available, then discarded oil drums were strapped on the sides of the vehicles, grates installed, and charcoal used as fuel, the producer gas thus made running the engines fairly well until they got too badly

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*Consulting Metallurgist, Beverly Hills, Calif.

corroded. In solving the acute problems, it was a revelation to watch the aggressive competence of some of the young workers, several of them college "engineer" graduates, many nongraduates. Most of them spoke fluent English and are fitting themselves to take a leading part in the New China.

It was a little difficult to expedite any one process. Things had to be taken in their natural course, which was a long way from the hectic haste often observed in United States plants. In some cases this did not lend itself to speed of operations. Proper drawings had to be made and "paper work" planned in detail. Tea drinking filled the author with apprehension that he would never sleep again, until it developed that most of the sixteen cups (by actual count) taken in one day were simply hot water added to the original pot of tea.

Samples had to be cast, and a split wood pattern was given to an apprentice molder who appeared to be a child around twelve years old. However, Mr. Wu, the ever-present interpreter, said that the molder was about twenty. Incidentally, Mr. K.T. Wu (Kuang-Ta Wu) is a mechanical-engineer graduate from one of the large universities who has a good command of English and has great ambition to come to the United States for two or three years' work in some plant so that he might some day be of more value to China. (Agricultural, railroad, or motor plant preferred.)

Samples were poured and showed good iron in spite of low-grade raw materials. The lads who operated the cupola furnaces were active and well trained. The product obtained revealed the fact that the molding sand was extremely poor. It melted on the shells, and an immediate search was begun for better sand. Holes were dug along the mountains and by the roadsides, and finally a material of fairly good quality was located and some of it trucked to the foundry. Such trips were not always devoid of recreation, as the ever-hospitable Chinese officials usually managed to work in a side trip to some famous and interesting spot.

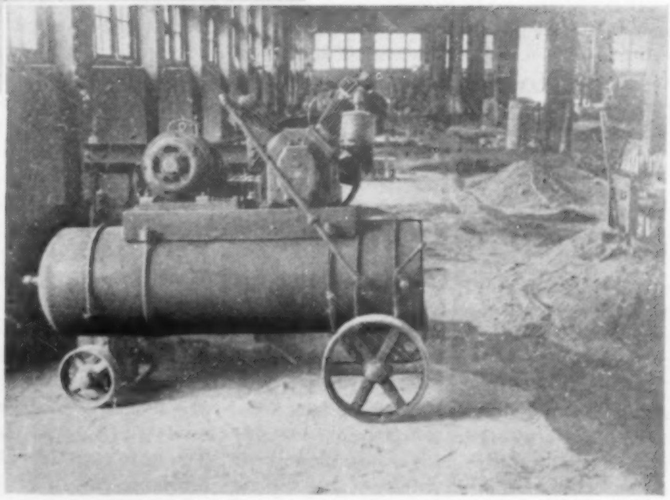
Upon starting in earnest with the new molding sand, the author voiced regret that no equipment was available for testing it. However, after a walk from the foundry, he was shown complete facilities of this kind that had come from Detroit, Mich., and it was put to immediate use on the job. Clay for the molding sand was ground in a circular mill, quietly and efficiently powered by a sturdy water buffalo. Pessimistic as to the suitability of the sand, experiments were initiated which promised to substitute permanent metal molds for sand molds, this work proceeding "concurrently" (to use a favorite word of the Chinese) with that on the sand molds.

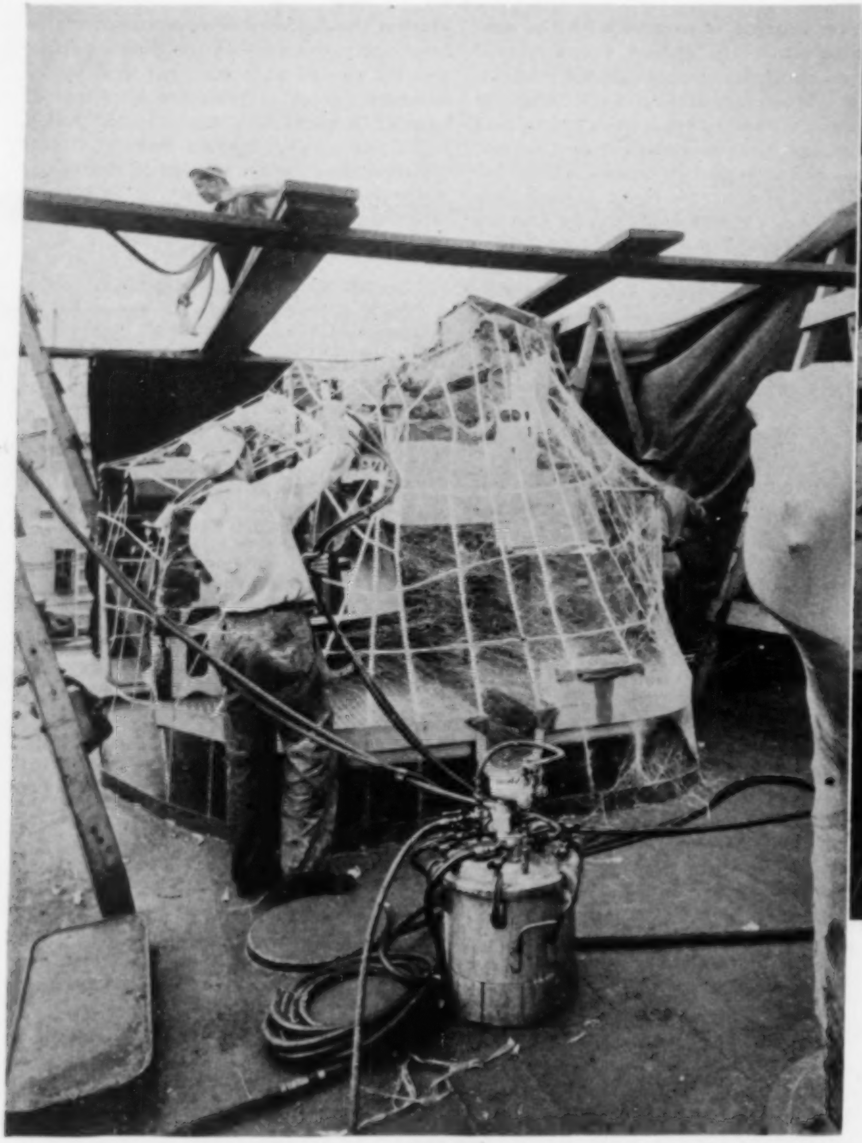
In the meantime, a modern American molding machine was dragged out from storage, and it was obvious at once that compressed air would be essential for its operation. After some delay, the storage shed was again visited, and this time (happy day for us) a little portable air compressor was dragged out! Some rubbing disclosed that it was an Ingersoll-Rand unit, No. 17164, and it developed that it was just about one year old. (Must have been flown there by our Air Forces.) By connecting its motor with a power line, compressed air was soon being delivered, and was it welcome! So shell production finally got underway.

Last pleasant memories were of a farewell dinner, with its incomparably spicy Yunnan ham and the hopeful way in which one after the other of the ever-courteous Chinese engineers would smile, and nod, and say *Ganbei* and the writer would drain the tiny teacup, inverting it to show that it was empty. But the two high spots of the job were when I-R 17164 started the delivery of compressed air to help out the American molding machine and the rest of us in the fight against the common enemy and when a long line of heavily loaded olive-drab trucks pulled from the newly opened Stilwell Road through the crowded streets of Kunming, with the young populace wiggling their thumbs in the air and screaming excitedly, *Ding Hao*!

AROUND THE FOUNDRY

The view at the bottom-left shows hot iron coming from the cupola. Beside it is shown the small, air-cooled compressor that saved the day by furnishing air to operate a molding machine. The records indicate that it was delivered in April, 1943, to one of the Army air fields in the United States. It was probably flown into China. The entrance to one of the foundry divisions that were put underground as a precaution against Jap bombs is pictured immediately below. Where gasoline and alcohol could no longer be had, trucks hauling vital raw materials were converted into gasogenes. Old oil drums, provided with grates, were strapped on their sides and served as charcoal burners (center).





Putting Dogs of War

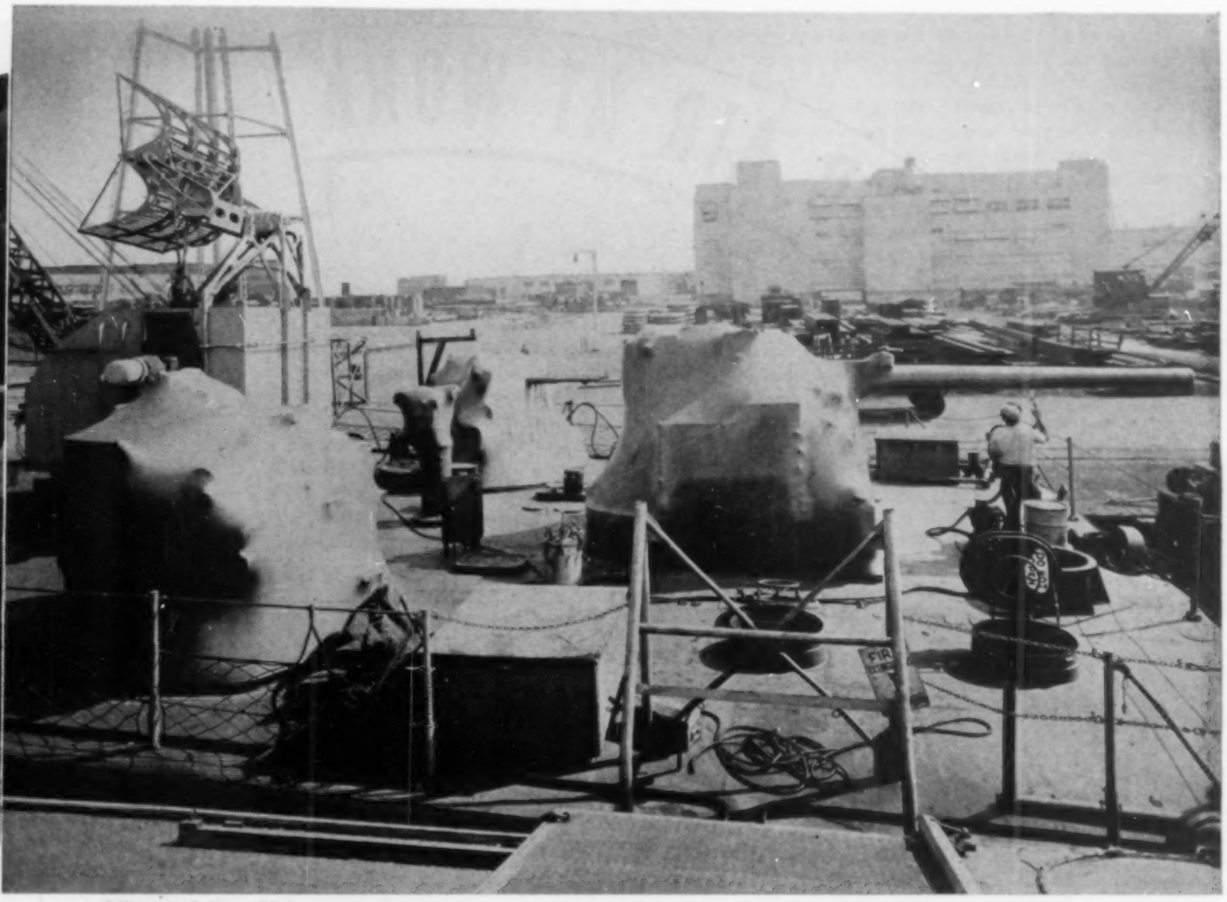
HUNDREDS of battlecraft of all sorts and sizes will form the reserve fleet that will be laid up inactive now that firing has ceased. To protect their deck guns so that they can, if necessary, be used on short notice, the Navy will place them in "live storage" by sealing them against intrusive air in moisture-proof cloaks of new plastic materials.

This method of outside storage saves time and money because it obviates the outlay and labor involved in moving the weapons from shipboard to a shore storehouse where nothing short of coating with grease, also perhaps swathing in some suitable fabric, and then the exercise of continual vigilance can be expected to arrest or safeguard them against rust and corrosion. Greasing and wrapping take time, and hours may have to be spent subsequently in removing the protecting layers, for an inspection of ordnance stored under these conditions is not satisfactory unless it is completely done.

By the up-to-date live-storage method the moisture content of the air within the plastic envelope or cloak is automatically indicated by an ingenious device which is made visible to the observer through a hermetically sealed window in the gun covering. If the moisture content nears the danger point, then the confined air can be displaced by suitably dry air which, at the same time, helps to locate the point of leakage so it can be closed.

According to information made public by the Bureau of Ordnance of the U. S. Navy, it is likely that many millions of dollars worth of fighting equipment will be wrapped up in the strippable film just as it stands on board the fighting craft of the reserve fleet. When called again into active service, the guns and their auxiliaries can be quickly freed of their moisture-proof cloaks and will immediately be ready for duty at their designed stations. To quote from *Naval Firepower:* "Getting ordnance out of grease and into action is no five-minute nor even a five-hour job. But one man has taken a 3-inch gun out of strippable film in 90 seconds."

To envelope guns the new way, liquid plastic is applied by means of compressed air in much the same fashion as surfaces are coated by spray painting, but the operation differs in important particulars. The first step is to stretch Scotch tape from one projecting point of the mounted weapon to another in a manner to blunt or to lessen the angularity of the whole structure. This provides a foundation network on which to deposit cobwebby filaments that spread like a translucent mesh across the gaps between the lines of tape. It seems that the sprayed liquid plastic floats down on to the tape like a strong but thin veil that solidifies and grips the supporting network. The film is strengthened by additional coats when and where necessary. The last application gives the "cocoon" the appearance of frosted silver.



Official U. S. Navy Photos

STEPS IN PACKAGING

These pictures show progressive operations in enveloping fighting equipment on the U.S.S. "Holder." Each weapon is first encased in a framework of Scotch tape with rather wide spacing. A web coat of liquid plastic is then applied. The spray gun emits long, web-like threads that bridge rather than pass through the relatively large openings. Repeated spraying produces an envelope of interlaced and overlapping threads. After the initial webbing has been formed, the piece receives three applications of coating solutions each of which is dyed a different color to make certain that the entire surface is covered each time. Each coat, in turn, masks out the color of the preceding one. The first of the applications primarily strengthens the initial web, while the second and third coats are protective. As the plastic dries, it contracts, resulting in a tight, form-fitting envelope. The spraying equipment is supplied with compressed air at 100 pounds pressure, and this is reduced as desired by a regulator which also serves to remove oil and moisture from the air. The final operations begin with the cutting out of a square section of the coating. The package is blown free of solvent vapors with a hot-air blower inserted through a slit made at another point. Then a drying agent is put inside the envelope, a transparent-plastic window for inspection purposes is placed over the square opening, and it and the slit are sealed by spraying. These envelopes, commonly called "bubble gum," will withstand exposure to wind, rain, snow, and sleet, and temperature ranges from –40 to 170°F. They can be readily repaired or patched, or additional coatings can be applied, if needed. Furthermore, the package can be painted or topcoated with other materials to give further protection where conditions require it. Both portable and truck-mounted spray equipment are available for the work, and each outfit is usually served by a team of three men.

in "Live Storage"

R. G. Skerrett

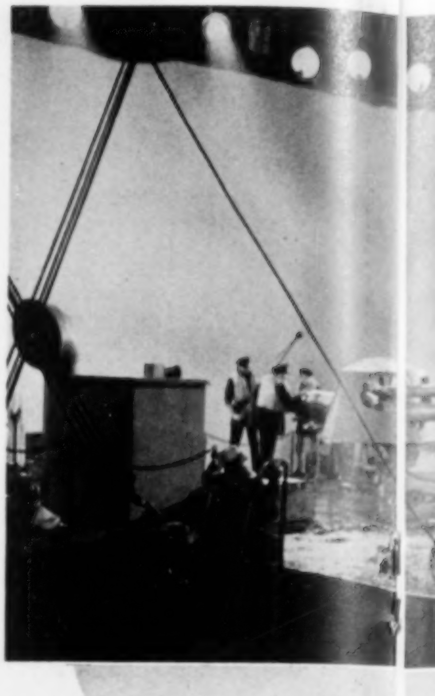
After coating is completed and before final sealing at a predetermined point, the air within the package is driven out by filling the confined space with heated air. Then a suitable desiccant is placed inside in sufficient quantity to keep the imprisoned air at low humidity that will safeguard exposed metal surfaces against rust or corrosion. The desiccant may be of a type that will change color to indicate any break in the plastic envelope through which moisture-laden air may have entered and to give warning of that fact before damage can occur because of that instrusion.

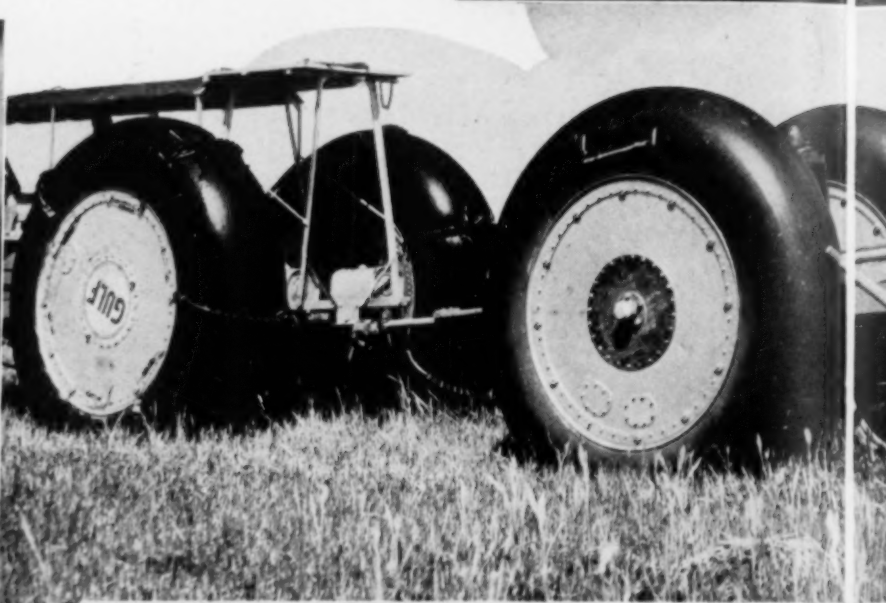
Convincing proofs of the effectiveness of strippable film in protecting naval ordnance both ashore and afloat have been made at the Philadelphia Navy Yard and at the U. S. Naval Shipyard in Brooklyn, N. Y. At the latter station the U. S. S. *Holder*, a destroyer escort that was seriously crippled by torpedo attack in the Atlantic during World War II, served as a test ship for the new method of live storage, and the accompanying pictures were made aboard that vessel and show the deck guns before and after coating. The surfaces of the projecting gun barrels also are sprayed with the plastic, which clings to but does not adhere to the netal. Starting incisions are all that is necessary to lift a strip, which can be pulled off easily, thus facilitating the removal of the entire film.

The same process of spray-packaging is being used at the Naval Ordnance Plant, South Charleston, W. Va., for placing many calibers of rapid-fire naval guns in storage. It is understandable, therefore, why the Bureau of Ordnance believes that "The plastic covering will be a quick, easy, and efficient way to get the guns of the reserve fleet under cover as soon as ships are tied up at permanent anchorages."

COMPRESSED AIR AT WORK

AMPHIBIOUS vehicles called marsh buggies have become standard equipment with oil-field geologists conducting geophysical investigations in the swamplands of the southern United States and Central America. The one shown below, right, is used by The Gulf Research & Development Company in Louisiana, Texas, and Florida. Its pneumatic tires, made by Goodyear, are 10 feet high and 66 inches in diameter. The wheels are hollow, airtight aluminum drums, which give added buoyancy. The marsh buggy can travel 4 miles an hour in water and 20 miles on land.

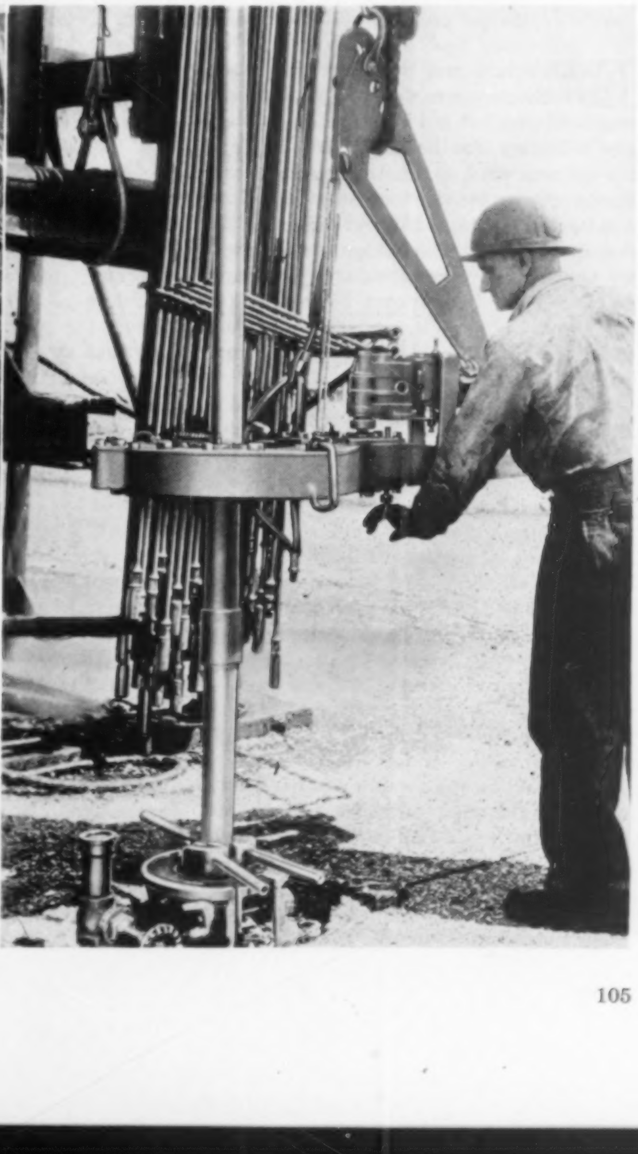




THE Westinghouse worker shown above is using compressed air to spray powdered glass, suspended in a liquid, on Kovar, an alloy that expands at the same rate as glass. This is part of a new method of making permanent, airtight, metal-to-metal glass seals in electronic tubes. Previously, Kovar had to be exposed to flame to oxidize its surface the correct amount, then heat-softened glass was pressed over it while still hot. Now the alloy is heated in temperature-controlled ovens to oxidize its surface, the powdered glass is sprayed on, and the piece is again heated to fuse the glass. To this film can be sealed other glass in the ordinary manner and by relatively low-skill workers. The new technique eliminates variations in Kovar oxidation, and the work can be conducted on a mass-production basis.

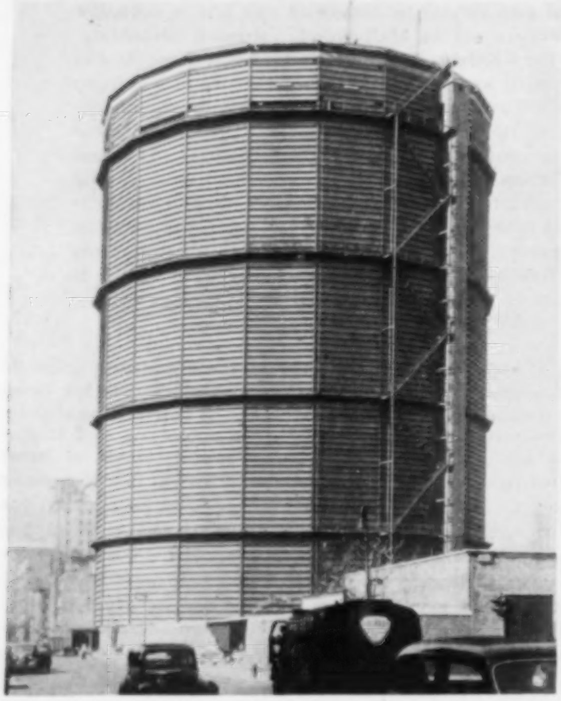
THE 5-inch naval gun shown in action at the left is actually on a motion-picture set in Hollywood. Russell Sherman, special effects man for RKO studios, designed it from Navy photographs, and it was built at a cost of $5,000. Pressure of a button causes a spark plug to fire a mixture of compressed air and acetylene, with a burst of flame from the muzzle. Titanium tetrachloride is added to produce a cloud of white smoke. The fast recoil of a real gun is achieved with a pneumatic mechanism using air at 60 pounds pressure. The weapon is returned to firing position more slowly by another pneumatic device operated with air at 14-16 pounds pressure. The gun has been used in filming many war pictures and has been changed in appearance at times to represent a German or Japanese naval piece.

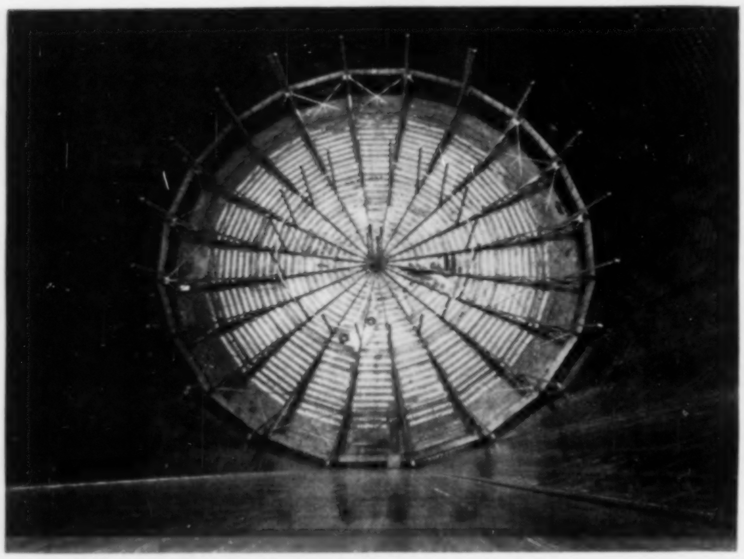
ONE of the laborious and time-consuming jobs in drilling oil wells with rotary rigs has always been the making and breaking of joints in the sectional tubing by which power is transmitted down the well to the drill bit. Traditionally, these operations have been performed by from one to three men, using a long wrench. The Hillman-Kelley power tong, below, utilizes air power to do this work. A pneumatic-drill motor (Ingersoll-Rand No. 44 close-quarter drill) turns powerful jaws that grip the pipe. When tubing is being disjointed, low gear, with a stalling torque of 3120 foot-pounds at 80 pounds air pressure, breaks the joint, after which a shift is made to high gear, which turns the jaws and the pipe at 48 rpm. With this equipment tubing can be run in or out of a hole two or three times as fast as by hand and with no muscular effort. The complete tong weighs 400 pounds and is suspended from the derrick by a cable, ready to be swung into position.



AT THE left is a car-oil cart that is used on the Erie Railroad for lubricating freight-car journal boxes. It consists of a piece of an old air receiver fitted with the required filling ports, an air-pressure gauge, a relief valve, and a discharge port to which a length of ½-inch hose is connected. At the delivery end of the hose is a pistol-grip nozzle to direct the oil into the journal boxes. Ten gallons of lubricant is put into the reservoir, after which the filling port is closed and the remaining space in the vessel is charged with compressed air at 50 pounds pressure from the shop air line. This is sufficient for lubricating 50 to 60 cars. Hand-can oiling, with its attendant annoyances and the need for frequent trips to replenish the supply, has been eliminated by this apparatus.

Roof Floated on Air During Wrecking Job





GAS HOLDER AND PISTON

Standing in a congested area, the big holder had to be dismantled with the bracing roof trusses in place to give the walls lateral stability as they were cut away, generally in 16¼-foot stages. This was done by the aid of the piston shown at the right, which had served originally to regulate the gas pressure. The view was taken from the top of the structure with the piston in its lowest position 250 feet down and with the temporary steel columns in position. The latter were in contact with the roof trusses as the piston was floated down on a cushion of compressed air. The tar seal that had prevented the escape of gas while the holder was in service was used to make it airtight.

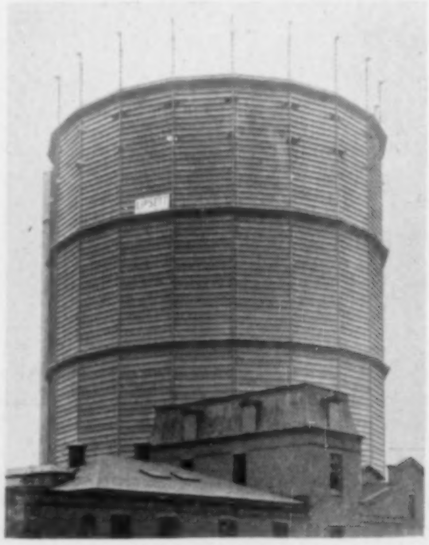
EVERY now and then compressed air is called upon to do some special, unusual job, and it is in this category that the following one belongs. In this case the air was used as a lifting medium and to operate pneumatic tools in dismantling a waterless gas tank 255 feet high and 174 feet in diameter. The holder was removed by the Lipsett Steel Products Company to clear a site in midtown New York for the Peter Cooper Village housing project of the Metropolitan Life Insurance Company.

Generally, in razing a structure in a built-up area, the roof comes off and then the walls are torn down progressively. But the holder with its unbraced walls of steel could not be handled in that way. With the roof gone, the walls would have constituted a menace because of a lack of lateral stability, and so some way had to be found to remove them with the roof in position to steady the structure during the dismantling process. On the face of it, this sounds like a Rube Goldberg scheme; but it was thoroughly practicable because of the structural features of the tank and the lifting power of compressed air.

Inside of the tank was a circular piston of slightly smaller diameter that moved up and down and had served to regulate the gas pressure. This member had a plane surface of 23,600 square feet and was provided for the work of demolition with numerous structural-steel columns. These were mounted on top of the piston and supported the roof as it was progressively lowered with the piston "floating" on a cushion of compressed air. The roof trusses, connected to the piston, represented a load of approximately 700 tons, the roofing material itself having been removed to light and ventilate the tank interior.

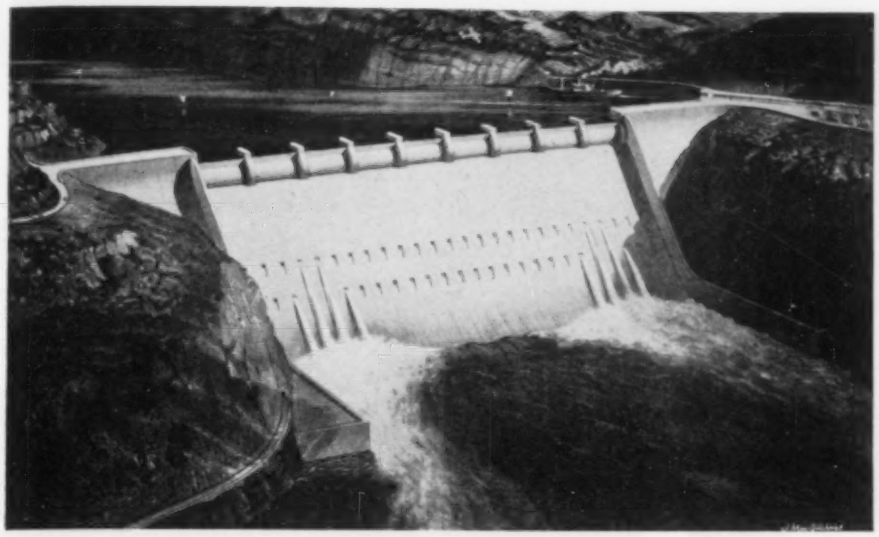
Before air was admitted to raise the piston, the structure was purged with an inert gas as a safety measure. Two fans, operating singly, delivered 39,000 cfm. each under a pressure of 6 inches of water (3.5 ounces), and that pressure was maintained until the piston columns were in contact with the roof trusses. Then the pressure was increased to 12.5 inches of water (7.2 ounces), the roof was cut loose from the walls, and the piston with its load was floated down 16 feet 6½ inches, where it was brought to rest on brackets that had been placed there previously. This left a part of the wall protruding above the roof, which served to give lateral stability to the section that remained standing. The projection was then removed with air-operated tools, cutting torches being ruled out because of the fire hazard. From that point on the work of lowering the piston and roof assembly continued in the same way in 16¼-foot stages, each of which was completed in approximately 40 minutes. Something like 2000 tons of steel was dismantled in this manner without endangering nearby structures.

Plans for the removal of the gas holder were made by W. H. Hoffmann, chief engineer of the Lipsett Steel Products Company.



PARTLY DISMANTLED

With the roof telescoped within the holder and resting on brackets fitted inside for the purpose, the steelwork rising above it was cut away by air-driven tools powered by two portable compressors operating in tandem.



BIGGEST OF ALL

An artist's conception of Yangtze Gorge Dam, which will be the largest structure of all time. It will be the central unit in a long-range program to rebuild the river valley by irrigating 10,000,000 acres of land, generating huge blocks of power, improving navigation, and providing flood control.

China to Build Biggest Dam

AIDED by engineers of the U. S. Bureau of Reclamation, the government of China is planning the largest irrigation and hydroelectric power development the world has ever known. The key feature of the project, which is intended to revitalize the densely populated, hunger-ridden, flood-menaced Yangtze Valley, will be a huge dam in a gorge of the river near I-chang and about 300 miles east of Chungking.

The statistics on the principal structures stir the imagination. The dam will rise 750 feet, exceeding the height of Boulder Dam by 24 feet. It will contain 15 million cubic yards of concrete, compared with 10 million in Grand Coulee Dam, and its mass will dwarf the largest pyramid. Its 250-mile-long reservoir will store 50 million acre-feet of water (Lake Mead above Boulder Dam holds 31 million acre-feet), which will be released as needed to irrigate farmlands, to maintain navigation, to generate power, and to provide flood control.

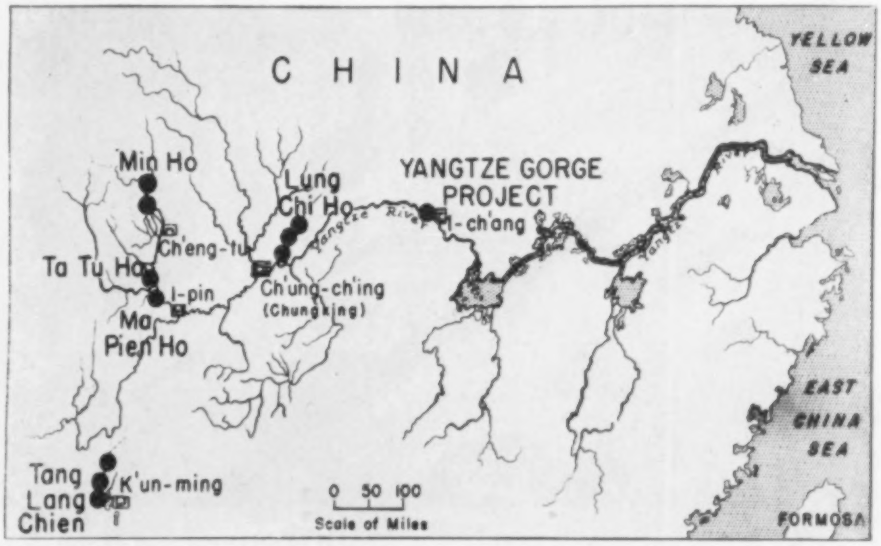
The hydroelectric plant will have three times the capacity of the Boulder, Grand Coulee, and Shasta stations, combined. The dam will turn the river flow through 96 Coulee-type, 108,000-kw. turbine-generators housed in tunnels driven through the solid rock walls of the gorge. All main power facilities except the switchyard will be underground. The power will be used to develop more fully the resources of the valley, to repay the billion-dollar cost of the undertaking, and to raise living standards in the area.

A ship lock of revolutionary design also is under consideration as a means of getting vessels past the dam. As planned, it is a mechanical lift which is to raise or lower loaded craft a distance of 550 feet. A 200-foot-high tunnel through solid rock will provide a passageway for vessels moving upstream to enter a lock basin at river level. While a ship floats in the basin, cables from large gantry cranes straddling the top of the lock will be lowered and fastened to the hull. The cranes will then hoist the craft above the dam, travel with it along tracks, and lower it into a navigation channel at reservoir level. Ships that are so handled will have to be specially built with strengthened hulls and frames, because a boat of normal construction would buckle or break if suspended in this manner. Sampans and junks will be gathered into a big metal tank and lifted over the dam like a basket of milk bottles.

Contingent upon the rearing of the dam is a comprehensive scheme to rebuild the valley from the rice roots up. Within a 300-mile radius from the dam site recurrent famine and flood have devastated an area having a population greater than that of the entire United States.

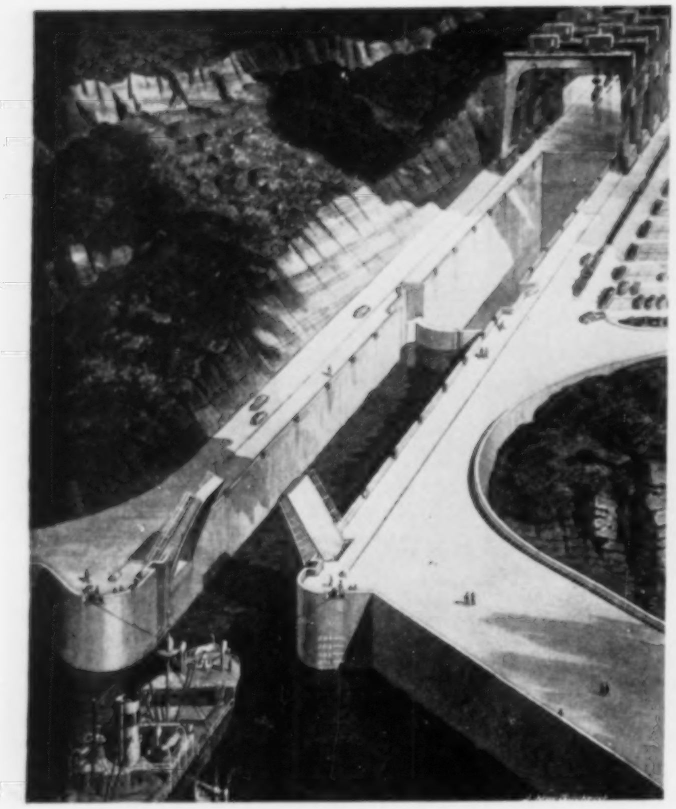
In planning the undertaking, the Bureau of Reclamation is lending its aid under a contract between the Government of the United States and the National Resources Commission of China. The cost of its services is estimated at $500,000, of which $250,000 has been paid. The agreement specifically states that the United States assumes no responsibility for financing the project or for its construction. Work on designs and specifications is underway in the Bureau's Denver office, in charge of Chief Engineer Walker R. Young. Preliminary over-all plans were prepared by John Lucian Savage, until recently chief designing engineer of the Bureau. Mr. Savage, who laid out Boulder, Grand Coulee, and other notable structures, is consulting engineer to the Chinese Government.

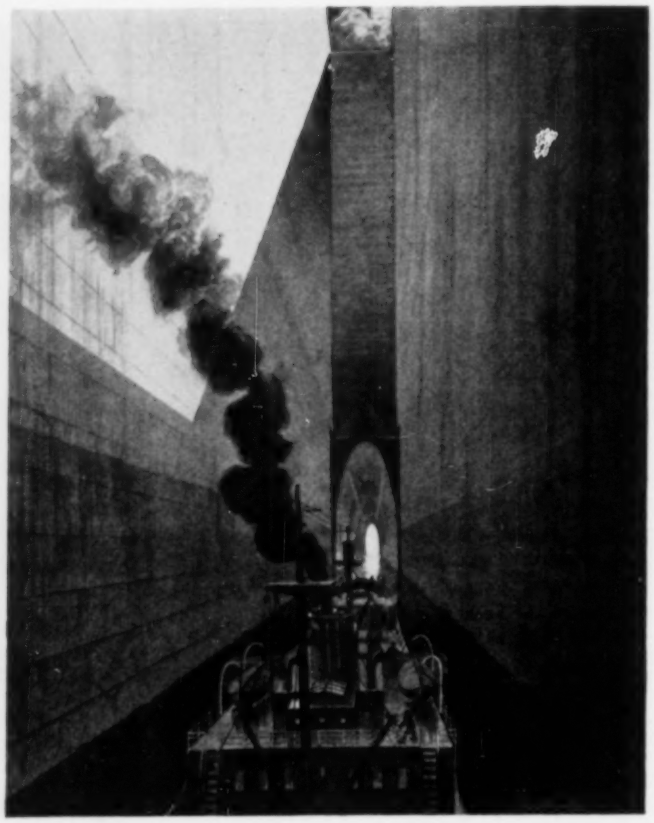
The Yangtze is China's greatest river and normally carries half the country's commerce. Its mean annual flow to the sea is estimated at 770,000 cubic feet per second, and at its mouth it carries 6,428,000 cubic feet of sediment a year. The dam site is approximately 1000 river miles from the coast. Rapids in the gorge above I-chang that will be inundated have constituted a hazard to navigation.

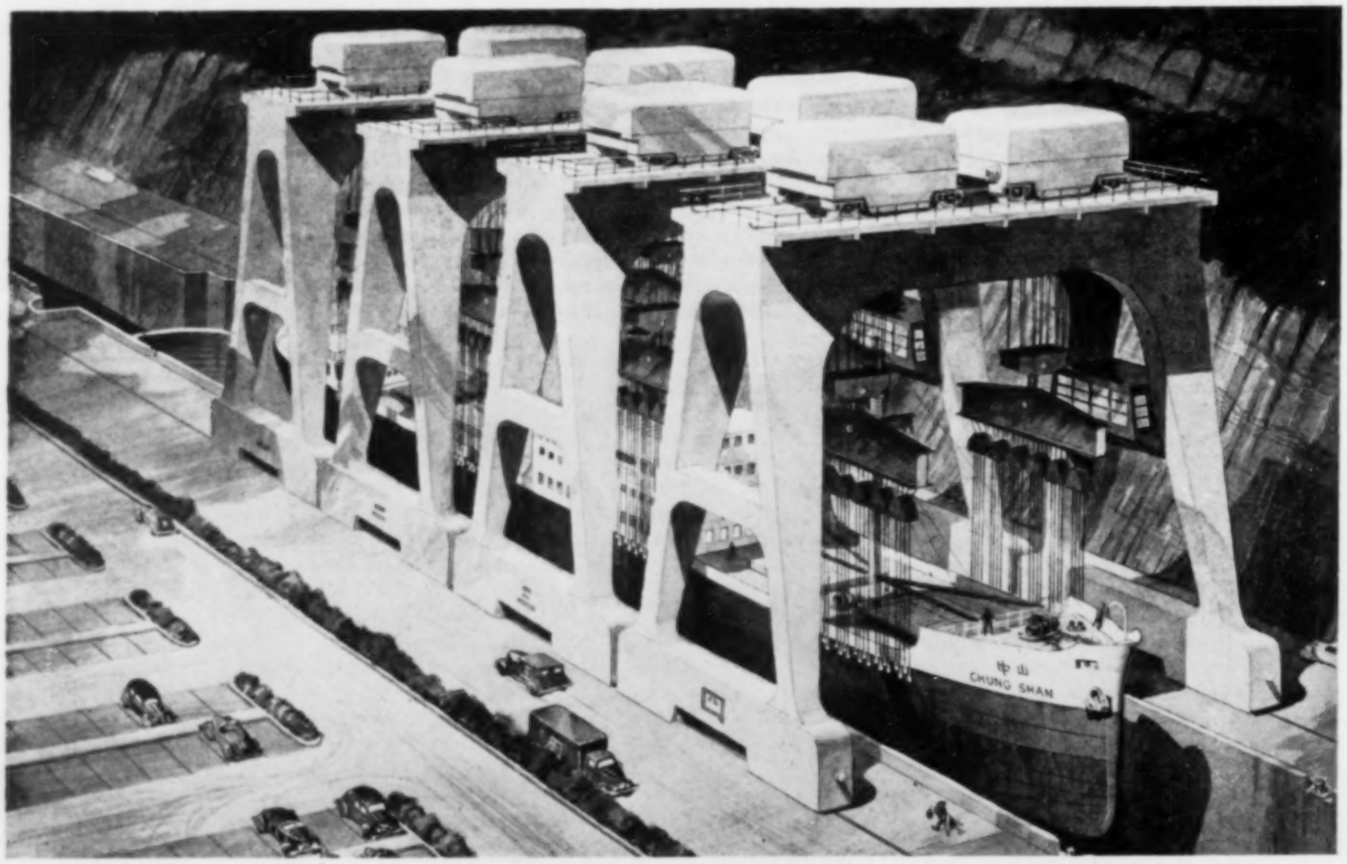


THE YANGTZE WATERSHED

The Yangtze River, which has been called China's life line, rises in the western mountains and flows eastward 3000 miles into the China Sea. It drains an area of 690,000 square miles, or nearly four times as large as the State of California.





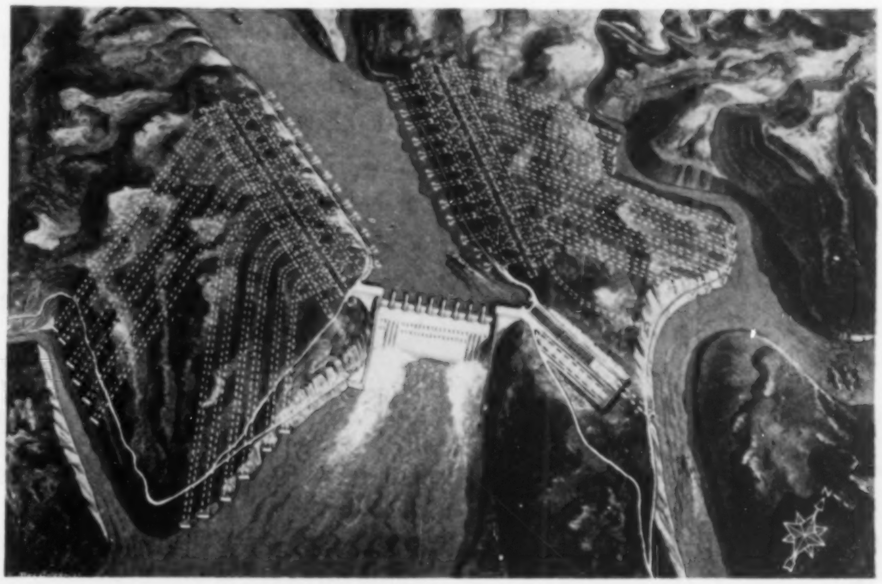


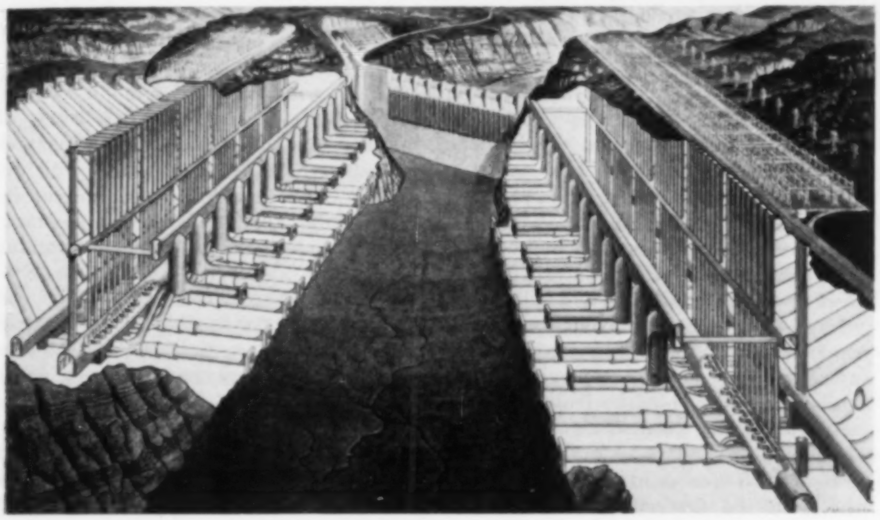
AN ELEVATOR FOR SHIPS

Under consideration is a scheme for raising and lowering ships mechanically to get them past the high dam. At the upper-left is pictured a vessel moving into the lock at reservoir level. The gantry cranes in the background will pick it up and lower it 550 feet to the bottom of the dam. Thence, as illustrated at the upper-right, it will move under its own power through a 200-foot-high tunnel to the river. The bottom view shows the cranes with a ship suspended in their tackle. Small craft will be grouped in a large metal container and handled like a basket of milk bottles.

UNDERGROUND NETWORK

An aerial conception of the dam and its associate works. The dotted lines indicate the paths of the tunnels that will take water from the reservoir, direct it through buried turbines, and discharge it back into the river or tributary waterways. The ship lift and its connecting tunnel are at the right of the dam.





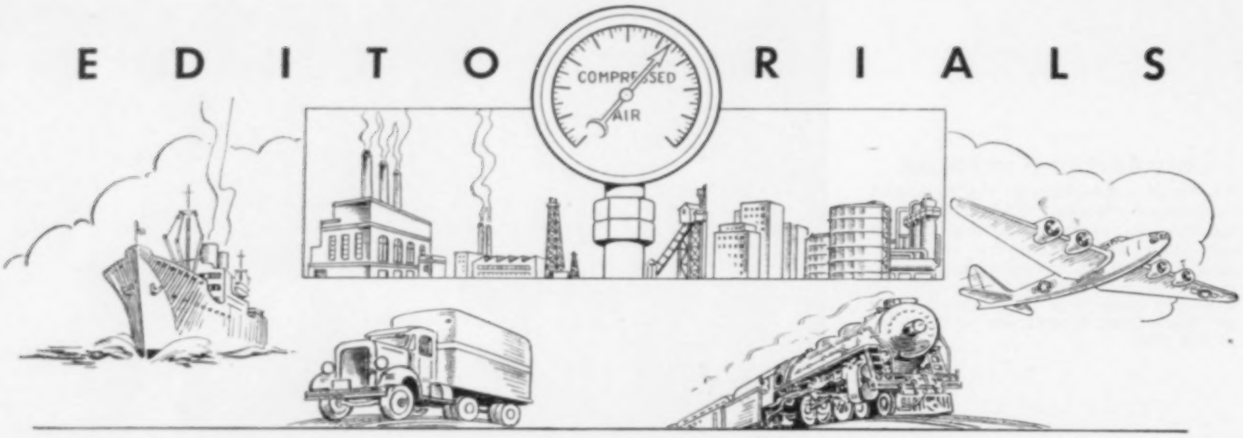
GENERATING EQUIPMENT

A cutaway drawing that shows the proposed arrangement of the generating system, with the turbines nested in the concrete-lined tunnels, the intakes of which will be far below the normal full level of the reservoir. The projected ultimate generating capacity is 10,560,000 kw., or more than three times the combined ultimate power output of Boulder, Grand Coulee, and Shasta dams.

DESIGNER ON TOUR

John L. Savage, designer of Boulder and Grand Coulee dams, made the preliminary designs for the Yangtze project and is serving as consultant to the Chinese Government. He is shown here, accompanied by Chinese engineers and officials, making a sampan reconnaissance of the Yangtze Gorge. This tour was made in 1944, when many of the Yangtze tributaries were still in the possession of the Japanese.

EDITORIALS



50 YEARS OF MOTOR CARS

THE American automobile industry will celebrate its fiftieth anniversary next month with a million-dollar jubilee in Detroit, the city the motor car built. Ancient "one- and two-lung" cars will be brought out of museums to chug-chug through the streets; the first uncertain tryouts of pioneer cars will be reënacted; there will be parades galore, dancing and confetti throwing, and a general carnival spirit will be evident. Old-timers in the industry will be feted and honored, and it is hoped to have in attendance such pioneers as Henry Ford, J. F. Duryea, W. C. Durant, Ralph DePalma, R. E. Olds, C. W. Nash, Barney Oldfield, Eddie Rickenbacker, and others.

America owes a lot to the automobile—a lot of pleasure, a lot of prosperity, and a lot of grief. Once the plaything of the rich and the mechanical tinkerers, long an object of derision of the "get-a-horse" variety, the fabulous "horseless carriage" is now considered a necessity in most households; and at one stage in our hectic national history there was a slogan calling for two in every garage. Soon after their appearance they were branded as dangerous to public life and limb, and there was a time when they were all but forbidden to use the thoroughfares of some of our cities. Even now they take an appalling toll of life every year, but we have become so inured to this eventuality that virtually no one is stayed from riding in them or driving them.

Contrary to popular opinion, the automobile is not an American invention. A Frenchman, Jean Lenoir, invented the hydrocarbon motor, and a German, N. A. Otto, designed the 4-cycle internal-combustion engine that was later universally adopted for gasoline-driven machines. Gottlieb Daimler, a German, built the first motorcycle in 1885; and in the same year another German, Carl Benz, produced the first successful gasoline-engine-driven motor car.

When the news reached this country that "horseless vehicles" were running in Europe, mechanically minded men in many towns and cities tried to construct one of them. For the most part their efforts went unnoticed, or were looked upon as the wasted energy of crackpots. There was no such thing as a concerted endeavor to develop even an engine, let alone an entire car. Every pioneer builder was on his own.

Most of this early work was done in small-town shops. Ford was a mechanic in a powerhouse; Duryea was in the bicycle business; Pierce was a manufacturer of bird cages, iceboxes, and bicycles; Winton a bicycle repairman; Franklin a die caster. Haynes was a field superintendent for a natural-gas company who was irked by the slowness with which he could get around by horse and buggy. Edgar Apperson, who made the first Haynes car run, was a repairer of bicycles. The Studebaker car emanated from a wagon factory, and the Peerless from an establishment that had been making clothes wringers. No one seems to be able to say who built the first successful American gasoline-driven automobile, and the honor is generally divided among Ford, Haynes, and Duryea. Regardless of who was the pioneer, he was not the first here, for an electric model ran on the streets of Chicago in 1892. In the early years of the industry, electric and steam-powered cars were far more numerous than the gasoline type. The electric machine lost out because facilities were not available for the frequent charging it demanded; the steam machine because drivers were required to obtain an engineer's license.

The first American cars were far inferior to those made in Europe, as all the early races proved conclusively. The imported automobiles ran away with all the prizes, and domestic models were considered wonderful if they so much as finished the tests. The reason for the superiority of European machines was that they were literally built to order for wealthy purchasers. Cost was a minor consideration. The best materials available and much fine handwork went into them. Although the early American cars also were hand-built, they lacked the refinements of those turned out abroad. And when the manufacture for the multitude began, such parts as could not be produced in large quantities under factory conditions were left out, or an easy-to-make substitute was adopted. In the end, of course, American "mass-production" methods won out. Foreign builders still chiefly turn out *de luxe* creations for wealthy persons. The less "ritzy" but still practical machines that come off American assembly lines by the thousands prevail in almost every market in the world. Thus, while Europe brought the automobile into being, Yankee ingenuity and business acumen made it available to the average man.

In 1896 there were perhaps 300 cars in the United States, but so few of them were in general use that only sixteen were registered. Ten years later, despite public disapproval and poor roads, their number had increased to nearly 78,000. They lacked much in dependability, and it was not until 1904 that an automobile was driven across the continent. That year, reflecting public resentment over the accidents they caused, New York State enacted legislation limiting the speed to 20 miles an hour and restricting it to 10 miles an hour in built-up urban districts. Several other states followed this example. To combat the unsympathetic attitude towards their horseless carriages, to advertise them, and to test them under severe conditions, the makers turned to racing.

Today, with four virtually nonproductive war years behind us, 25,500,000 automobiles are registered in the nation, and there is a backlog of orders for millions more. Our motor-car industry is a four-billion-dollar giant, having grown from "a cluster of alley shops to an enterprise spread over 44 states and a dozen foreign countries." It has been responsible for the expenditure of many billions for roads and streets, for improved petroleum-refining processes, and for the hundreds of thousands of garages, service stations, and other facilities that extend into every village. Directly and indirectly, millions of our population obtain their income from the amazing "gasoline buggy" that came into production just 50 years ago.

This and That

Are Lakes Land? The Public Roads Administration in Washington lists the area of the State of Michigan as 58,216 square miles, while the Census Bureau certifies it as 96,791 square miles. The increase in the second case is due to the inclusion of those sections of the Great Lakes and Lake St. Clair that lie within the state's official boundary lines. Michigan's highway department wants the Public Roads Administration to recognize the larger figure because, under the Federal Aid financing plan for roadbuilding, it would boost the state's allotment by about $9,000,000 in three years. In support of its position, Michigan cites that the Federal highway authorities include such bodies of water as Lake Okeechobee in Florida and Great Salt Lake in Utah when computing the areas of those states.

* * *

Cleaning Sand for Concrete Compressed air was used during the late war in numerous ways, ranging from the operation of flame throwers to the flotation of ships. One of its minor, but still important, services was that of helping to provide satisfactory sand and gravel for concrete aggregates. Engineers could draw cement from military stores, but they usually had to depend upon local sources of supply for fine and coarse aggregates. Since clean sand is essential to strong concrete, some means of washing it generally had to be set up. Sand found in the beds of running streams could be readily washed merely by inserting perforated pipes into it and agitating it with compressed air. Mud, silt, and other ultrafine materials were thus floated and carried away by the flowing water. In many cases where sand was obtained from dry pits, similar washing arrangements in the form of tanks, sluiceways, etc., were built.

* * *

Soviet Oxygen Research According to *Foreign Commerce Weekly*, a new method of producing liquid oxygen is being used by the Russians in a plant near Moscow. Details of the process are lacking, but it is said to be "based on turbine installations." It is reported that the new machinery requires only one-quarter as much floor space as the previous set-up, and that the former daily output has been increased six to seven times. Consequently, oxygen can be made available to industries in larger amounts and at lower cost. In addition to employing oxygen for cutting and welding metals, for high-altitude flying, and in the chemical field, the Soviets are extending its application to the steel industry. Introduction of the gas into blast furnaces nearly doubles the production of pig iron, it is claimed, and also reduces operating costs by 15 percent. It is indicated that oxygen will also be used in a 2-ton steel furnace planned as a part of a new machine-building factory at Sverdlovsk. It is further reported that the Moscow oxygen plant exceeds in capacity all other Soviet facilities combined and that the product is pure enough to serve in respiratory apparatus.

* * *

More About Oxygen Last month, Dr. Melvin Calvin, University of California chemist, disclosed a hitherto unannounced American wartime process for extracting oxygen from the air. It works on the same principle used by the human body to supply the blood stream with oxygen derived from air breathed into the lungs. In the body, the absorptive agencies are iron compounds, while in the commercial system they are organic chemicals that are called chelates and contain cobalt. When air is blown through a tube lined with the red-colored chelates, the latter take up oxygen. When they have become saturated, the air flow is stopped. The tube is then heated, and the oxygen is given up and delivered into storage tanks. The cycle of operations is repeated, over and over. Doctor Calvin said the new process was used to supply oxygen for welding and other operations in South Pacific battle areas where the usual sources of supply were not available.

* * *

The Rabbit Menace In January, 1945, we printed a brief and supposedly innocuous item regarding the use of carbon-monoxide gas obtained from charcoal burners to kill rabbits in Western Australia. We were primarily interested in the fact that blowers are employed to force the lethal gas into the rabbit warrens and only incidentally concerned about the nature of the gas. But we unwittingly included a statement, taken in good faith from an Australian technical publication, that the farmers were able for the first time to deal effectively with the rabbit menace. This got us into trouble with the American makers of "Cyanogas," who furnished us with ample evidence that their product had been introduced there some twenty years ago and extensively applied ever since. We made due amends in our October, 1945, issue and thought the incident closed.

However, the matter is apparently of considerable import in Australia, for we now have a letter from a Melbourne engineer assuring us that the charcoal producer-gas units were in service some years before "Cyanogas" appeared and that they are still being made and sold by the original manufacturer. This, our correspondent points out, is sufficient proof of their effectiveness. We certainly didn't foresee all these complications when we wrote our original item. To extricate ourselves from the crossfire of the respective claimants, we willingly concede that both exterminants are all that is claimed for them. We hold no bias for nor prejudice against either of them. In fact, we are beginning to feel that our position in the whole affair is much akin to that of Br'er Rabbit, and our sympathies go out to him.

* * *

3-year Bridge Repairs Evidence of the thoroughness with which the destructive forces of the German army operated is found in a report that it will take three years to repair Europe's longest bridges, the dual highway and railroad structures in Holland. These bridges cross the Hollandsche Diep at Moerdijk south of Rotterdam and form the only direct link between France and the large commercial centers of western Holland and Belgium. When the Germans retreated before the allied advance in November, 1944, they completely destroyed six spans of the 1.6-mile-long railroad bridge and seriously damaged three others. Four spans of the highway crossing also were demolished. In the work of restoration, the spans nearest the shore will be replaced by a stone dike projecting into the waterway. The railroad bridge will be raised 7 feet to permit the passage of larger vessels, the section will be electrified, and the 1870 single track will give way to a double-track line.

* * *

British Speed Records Our British cousins hold the speed records on land and water and in the air. Sir Malcolm Campbell set the world motorboat record of 141.74 miles per hour in 1939. The fastest crossings of the Atlantic were made by the *Queen Mary* in 1938: 92 hours 42 minutes for the eastward trip and 93 hours 45 minutes for the westward passage. The fastest a human being ever traveled on land was when John Cobb drove an automobile over the Bonneville salt flats in Utah in 1939 at a rate of 368.5 miles per hour. The record for trains is held by the *Mallard* of the London Northeastern Railway, which set a mark of 125 miles per hour in July, 1939. Last November 7, Group Captain Wilson of the R.A.F. broke the air record when he piloted a Meteor jet-powered plane at a speed of 606 miles per hour.

Automatic Sand-Handling Plant for Railway Service

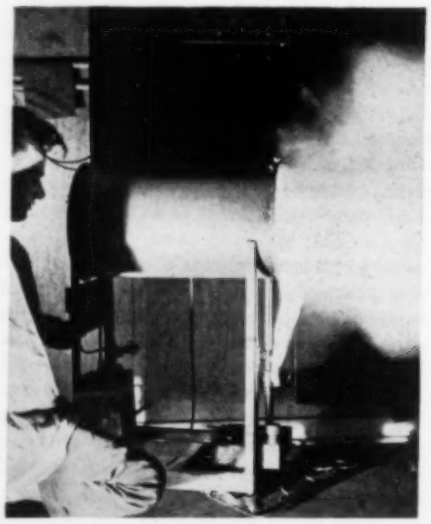
AT ITS diesel-electric servicing station at Marion, Ohio, the Erie Railroad has installed a sand-handling plant that functions automatically from the time a push button starts conveyors until they are stopped by a mercury-tube pendulum switch. Upon reaching the yard, the material is dumped through roof openings into a 70-ton wet-storage bin, from which it flows by gravity through chutes onto a 14-foot-long horizontal belt conveyor. At the discharge end the sand drops onto an inclined 40-foot flight conveyor, also motor driven, which feeds it into an 8-ton hopper beneath which are two steam driers.

As the material is dried, it falls through vibrating screens into two cylindrical elevating tanks or drums each of which has a capacity of 20 cubic feet. When they are fully charged, compressed air at 100 pounds pressure is admitted and blows the sand into two 20-ton towers which straddle the service tracks. The interesting feature of the elevating tanks is the photoelectric control of the air supply. Each is provided with a by-pass or gauge pipe in which are two glass windows arranged in line with an electric lamp on one side and a photoelectric relay on the other. When the beam of light shines through the windows, the air line is closed and the container is being charged with sand; when the tank is full, the material runs into the by-pass and blacks out the light. This causes the relay to open a solenoid valve, thus permitting compressed air to enter the container and to build up pressure, which first closes a plug valve to stop the flow of sand and then blows it into the associate storage tower. This operation is effected in 3½ minutes.

To insure complete discharge of the sand from the elevating tank and conveyor pipe, the system includes a pressure switch that functions in reverse. It is set to close its contacts when the air pressure in the container has dropped to about 25 pounds, thus shunting the contact made by the photoelectric relay and feeding air into the drum even after the by-pass permits the light to shine on the relay. When the tank is no longer under pressure, the switch opens, the solenoid valve cuts off the air supply, and the cycle is repeated until the tower is loaded—until the inflowing sand reaches and opens the upper of two syntron switches, thus starting a chain of operations that shuts down the entire system. The latter starts up again automatically when the sand drops to the level of the lower switch and sets it, as well as the one above it, for the next charge. Each tower has four hose outlets so that eight boxes on two locomotives can be serviced at one time.

Coating Inner Surfaces of Pipe with Metal

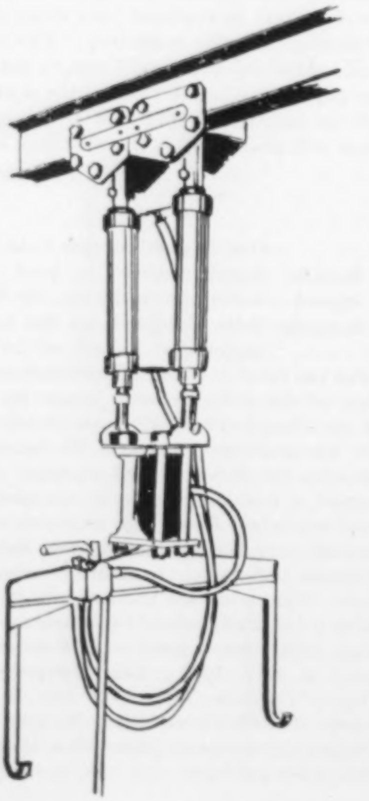
BY A NEW method devised by Bart Manufacturing Company the inner surfaces of steel pipe are being electroplated with nickel or other metals for the processing and handling of a wide variety of products, including petroleum, chemicals, foods, textiles, plastics, paints, and dyestuffs. Known as the Lectro-Clad Process, it is suitable for piping up to 18 inches in over-all diameter and about 20 feet in length. Pipe so treated is said to have the corrosion resistance of nickel, for example, and the strength and fabricating characteristics of steel. Further claims are that it can be welded and reduced and bent hot or cold without damaging any part of the lining. By the cold method, the actual thickness of the plating can be predetermined because the base metal and the deposited metal are reduced in equal ratio. Lining is smooth, ductile, and porefree. Fittings and pipe accessories for complete systems are available.



RIGOROUS MOTOR TEST

Here is shown an explosion of 100-octane gasoline vapors that constitutes part of a routine test of small explosion-proof motors at the Lima, Ohio, plant of Westinghouse Electric Corporation. A motor is placed inside the tank, which is then sealed. Below the tank is a smaller one containing gasoline. A blower atomizes the fuel and forces the vapor upward through two pipes. One directs the fumes into the motor and the other one fills the chamber surrounding it. The gas inside the motor is then ignited by means of a spark plug fitted into the shell. The motor is sealed so tight that only a harmless "pouf" results and the vapor all around it does not explode. To prove that the tank actually contains an explosive mixture it is exploded, as shown here. This test was devised during the war to convince the Army Air Forces that specially designed motors could operate in airplane compartments that had become filled with gas without causing explosions that might be disastrous to both ships and crews.

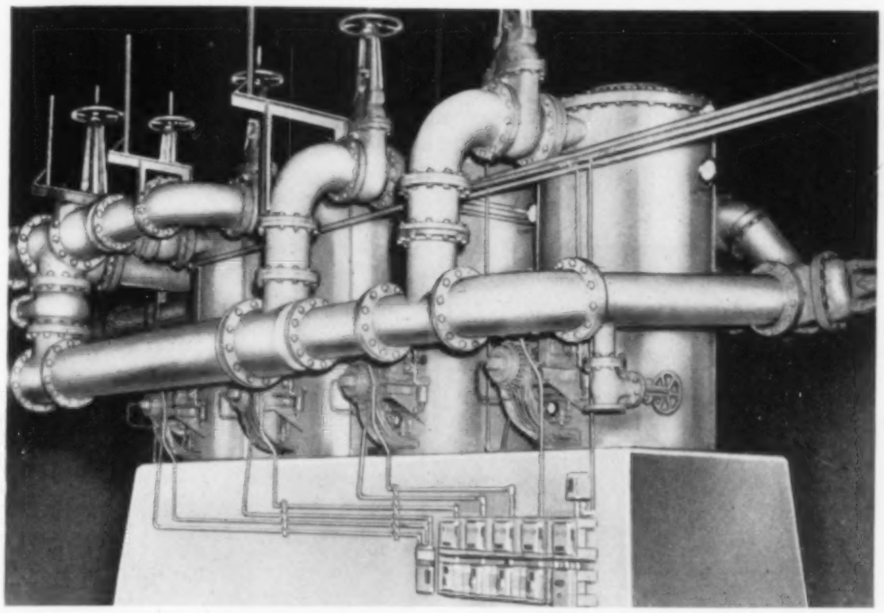
Combination Molding-Box Hoist and Vibrator

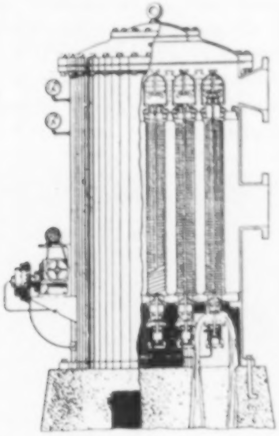


FOR use primarily in mechanized foundries to prevent slowing up of operations along the production line, the Adaptable Moulding Machine Company, Ltd., Birmingham, England, has designed a knock-out unit for molding boxes that travels on an overhead runway. The equipment consists essentially of two vertically disposed pneumatic-cylinder hoists and of a small vibrator. The latter is attached to the cylinder piston rods and to a crossbar provided with a pair of hooks and two levers that regulate the air supply to the hoists and the vibrator, respectively.

In service, the full molding box is placed in a container with an open, grid-type bottom. The load is picked up by the hooks, hoisted by admitting compressed air to the cylinders, and pushed along the runway by the aid of trolleys to the knock-out station. There air is fed to the vibrator which, in a few seconds it is claimed, breaks the hold of the sand on the casting and the box and causes it to drop out through the grid. The equipment is then moved along to the next station, where it is lowered, the casting removed, and the molding box returned to the beginning of the production line for refilling.

Automatic Filter with Pneumatic Purging Mechanism





SECTIONAL VIEW AND BATTERY OF FILTERS

Drawing shows disposition of the Poro-Screen elements and of the air cylinders. The element at the right is pictured with the raw-water inlet at the top closed and backwash pouring into the drain pit at the bottom. While it is being purged the others continue to supply filtered water. Units of this type range in capacity from 1000 to 2000 gpm. Above is a front view of a battery of four filters mounted in parallel. This installation handles 8000 gpm. The timing distributors that control the pneumatic purging mechanisms are between the horizontal inlet pipe and the concrete drain pit.

THROUGH the development of a Poro-Screen filtering medium that can be interchanged with Poro-Stone, R. P. Adams Company, Inc., has increased the serviceability of its automatic, multiple-element water filter for industrial use. The latter is available in four sizes of which the largest is equipped with 26 filtering elements or tubes having a total capacity of 2000 gpm.

Poro-Screen checks the passage of sand, grit, and other solids ranging in size from 0.002 to 0.004 inch and is designed for applications where the fine filtering characteristics of Poro-Stone (0.0005 to 0.0015 inch) are not required. Each tube is individually mounted, can be removed from the filter housing without disturbing adjacent ones, and is provided with an automatic backwash mechanism so that it may be purged or cleaned while all the others are supplying their quota of filtered water. This is done by means of a double-acting pneumatic cylinder operating a water inlet valve and a backwash outlet valve.

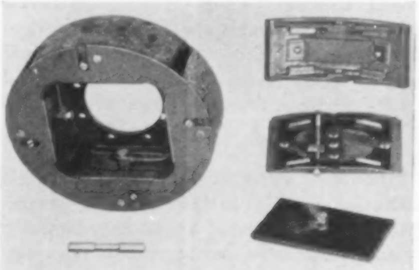
On the outside of the filter is a motor-driven timing distributor which controls the backwashing of the filter tubes and which, by means of an adjustment, can be speeded up or slowed down in accordance with the condition of the raw water —whether heavily fouled or relatively clean. The distributor rotates and, as it does so, admits compressed air at a pressure of 100 pounds into each cylinder in turn, raising the piston and thus closing the inlet and opening the outlet of the associate element. This reverses the flow of the water one tube at a time, backwashing the accumulated solids into a concrete drain pit on which the filter is mounted.

Purging takes only a few seconds. When completed, the automatic control releases the pressure on the pneumatic piston, again opening the raw-water inlet valve and closing the backwash valve. A 30-pound air cushion is maintained on the other side of the piston to return it to the filtering position. This cycle of operations is repeated, element after element, with whatever frequency may be required to keep the filtering tubes in the best possible service condition and without any appreciable reduction in the supply of filtered water.

Pneumatic Brake for Industrial Equipment

AN INDUSTRIAL brake that operates on ordinary shop air-line pressure and that is said to exert as much braking effort as conventional equipment using ten times that pressure has been announced by Linderman Devices, Inc. The brake, either direct connected to shafts or attached through flexible couplings or chain and sprocket drives, can be used to stop or to retard machinery or to provide a constant tension or braking effort. The latter is always proportional to the amount of air pressure applied to the four multistage diaphragms that actuate the shoes. The diaphragms are interconnected to assure equalized pressure circumferentially on all parts of the brake and require little air because of their extremely small volume when expanded.

The outstanding feature of the device is that about 90 percent of the drum is "filled" with lining, which is forced radially outward against the drum and with each square inch under the same pressure. This, it is claimed, results in maximum braking effort with no self-energizing action; accurate and smooth control; long lining wear; and permits the brake to operate in either direction with equal facility. The 14x4-inch size is rated at approximately 2100 foot-pounds torque when used intermittently for retarding or stopping. When serving as a tension device, it will absorb continually from 3 to 10 hp., depending on shaft speed and cooling. This rating is based on drum temperatures not exceeding 475°F. Separate air-circulating housing is available for use where brake application is frequent and heavy or drag is constant and heavy.

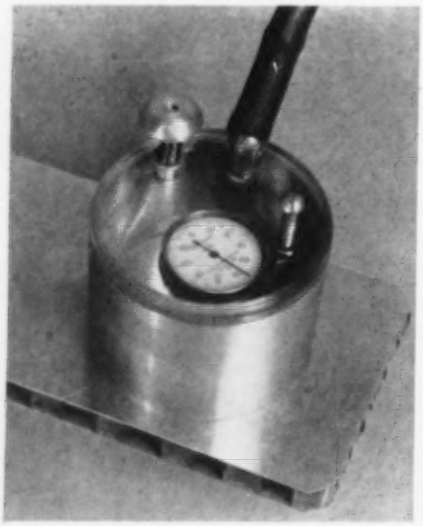


BRAKE AND PARTS

Right, from top to bottom, the two parts that form the adjustable shoe and the multistage diaphragm. At the left is the assembled brake with a shoe torque bar at the bottom. Note simplicity of design and large lining area.

Industrial Notes

Something new in instrument gauges has been developed by The Glenn L. Martin Company which claims that it will not only measure the thickness of metal and other sheet stock but also inspect the bonds between plies of laminated materials such as wood, plastic, glass cloth, etc. The device operates on the pressure principle and consists of a cupshaped shell with a transparent top wall and a rubber gasket around the lower edge. Mounted inside the housing is a dial indicator calibrated in thousandths of an inch and equipped with a stem extending to a spherically shaped foot that rests on the material under examination. When in use, a valve in the top of the case is opened and the air inside the gauge is reduced to normal atmospheric pressure by means of an exterior pump. A reading is next taken, and this serves as a standard for the test. Then the valve is closed, thus evacuating the air. Should there be a faulty bond or no bond anywhere within the sandwich-type construction, the "loose" area will pull away from the other layers against the foot of the gauge and be indicated on the dial by a deflection of several thousandths of an inch. In measuring the thickness of sheet metal, the pressures recorded during the test are simply checked against predetermined gauge readings for each specific thickness of metal.



Convicted some months ago of forging a $50 check, B. B. Stiles has been unconditionally discharged from San Quentin Prison to perfect a pneumatically operated artificial hand invented by him.

Two new compounds for the quick removal of weld spatter have been put on the market by General Electric Company. They are in powder form and made into a thin paste by adding water. It is claimed that surfaces, even if slightly oily, do not require wetting before application and that the preparations do not cause smoke. The results obtained with both are the same, only No. 9951 is nonadherent and can be wiped off with a dry cloth or blown off with compressed air, while No. 9952 necessitates the use of a damp cloth or a stream of water.

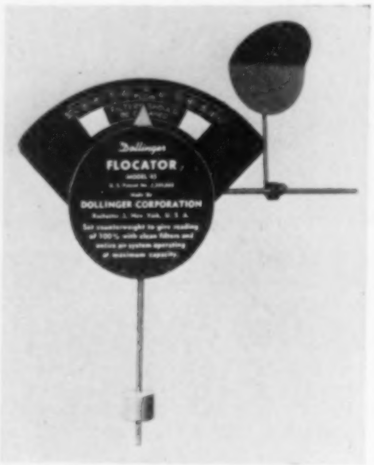
Tinol is a new solder in the form of a metallic paste that is said to be suitable for anything except aluminum. It's a finely granulated alloy of tin and lead mixed with an oily flux ready for use.

All tires made by The Dayton Rubber Manufacturing Company will be dated in the future—will have the month and year of production molded into the sidewall to the right of the serial number. Today's synthetic tires are far superior to those made during the early stages of the war, says the company, and tomorrow's will be even better. It has therefore decided to date its tires so motorists may know that what they are getting embodies the latest improvements in materials and manufacture.

Motorists, especially those whose eyes are sensitive to bright light, will be interested in a recent announcement by the Polaroid Corporation of Cambridge, Mass. The company is placing on the market a visor for daytime driving that is designed to comb out the glare which distorts his view and, on occasions, temporarily blinds him. The gadget is made of polarized plastics, and can be clipped on to any standard automobile sun visor.

The workman in the accompanying picture is using Flange-Jacks, tools designed by T. G. Persson Company to facilitate the job of opening and closing flanges for gasket renewal. Standard sizes are suitable for flanges ranging from 2 to 20 inches and will hold them with holes in perfect alignment. Further claims made for them are that they can easily open joints against a load of 15 tons without damage to the flanges and danger of sparking, a vital consideration where lines carry inflammable fluids or in the presence of gas fumes.

What is described as a new and inexpensive air-flow indicator has been put in production by the Dollinger Corporation. Named the Flocator, the instrument is designed for use in connection with any air-ventilating system and will, it is claimed, indicate the percentage of maximum flow at all times, thus warning against any loss from any cause. It is being manufactured in two models, Nos. 45 and 75, for small- and large-capacity systems, respectively, and operates continuously with little attention.


Dollinger
FLOCATOR
MODEL 45
Made By
DOLLINGER CORPORATION
Rochester 2, New York, U.S.A.
Set counterweight to give reading of 100% with clean filters and entire air system operating at maximum capacity.

MODEL 45

One nozzle delivering two jets of paint of different colors is the feature of a new spray gun announced by Sherwin-Williams Company. Known as Dimenso, the apparatus is said to give a wide range of 2-coat spatter finishes and iridescent effects in one operation.

At a recent fuel session of the American Society of Mechanical Engineers was described a method of pulverizing and drying coal that is based on the process used to produce puffed rice, wheat, and oats. The apparatus operates on the continuous explosion principle by which the raw material is passed through a jet of steam or air which, trapped in the coal, causes it to expand, powdering it and drying it at the same time.

A screw that is said to cut its own threads in any material is announced by the Continental Screw Company. Slot in end of screw, which corresponds to flutes in tap, provides two cutting edges and a chip reservoir, fine and curled metal chips, as well as tough nonmetallic cuttings, freeing themselves readily. Known as the Holtite Tap, it is claimed to cut perfectly mating threads which assure a fit that resists loosening even under severe vibration.

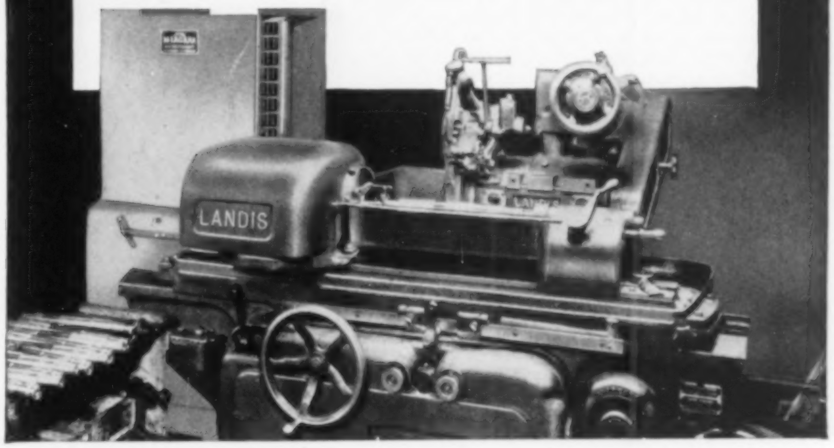
Fibron is the name of flexible, heat-resisting plastic tubing that is said to withstand varnish treatment and baking without stiffening even when operating temperatures are extreme. It is a product of the Irvington Varnish & Insulator Company, which reports that it is also resistant to strong acids and alkalies, denatured alcohol, petroleum and its products, and coal-tar solvents. Further, that it has performed satisfactorily in cases where high dielectric and tensile strengths are important factors.

Portable electric-generator sets suitable for supplying power for routine and special tests of control motors and similar equipment, for tool operation on a small scale, and for other purposes, are built by the Bardco Manufacturing & Sales Company. The units were originally designed for war service at advance bases, and especially for testing the complex electrical system of B-29 bombers on the ground instead of under flight conditions. One such plant consists of two 528-ampere, 28½-volt, direct-current aircraft generators driven by a 4-cylinder, air-cooled, 68-hp. aircraft engine and has an output of 15 kw.

Keeping paint brushes clean and soft seems to be one of those jobs that are bothersome, with the result that most of them are discarded long before they are too worn for further use. To prevent this waste, Nashway Company, Ltd., has designed a small electric tool that works on the same principle as a mechanical egg-beater. It spins a brush in a cleaning fluid, salvaging new and old stiff brushes alike, it is claimed. The device is called Spin a Brush and can be operated on 110-115 volt direct or alternating current. Tool also can be used to mix paint, to clean stippler covers, and to drill small holes.

Microfilming of documents and papers for filing is helping to conserve storage space in many banks, offices, and elsewhere where records are kept. Equipment used for this purpose has been improved upon by the Eastman Kodak Company so that it is now possible to photograph the front and back of a sheet at one time. The machine, named Duplex Recordak, accomplishes this by the aid of mirrors, and the two images appear side by side. It is said to reproduce both faces of 100 bank checks or reference cards on a foot of 16-mm. film, reducing their size 1000 times. The camera has two lenses and holds two rolls of films which can be exposed simultaneously, thus providing records in duplicate.

WOULD MORE PRECISE TEMPERATURE CONTROL OF LIQUIDS OR GASES
IMPROVE YOUR PROCESS OR INCREASE YOUR PRODUCTION?



The NIAGARA AERO HEAT EXCHANGER holds the temperature of a liquid or gas within close limits. Many units have been installed because they provide a less expensive and less troublesome way of cooling fluids in an industrial process. But, after installation, users have discovered additional benefits of extra plant capacity, increased production and better quality production because the NIAGARA AERO HEAT EXCHANGER provided accuracy of temperature control.

Cooling of cutting oils, lubricants, quenching baths, engine jacket water; chemicals and intermediates; electronic sets; condensing gases, steam and refrigerants; controlled atmosphere processes; compressed air after-cooling—are processes in which these *extra* benefits are obtained.

For further information, write for Niagara Bulletins 90, 94 and 96, or ask about experience in your own field.

NIAGARA BLOWER COMPANY
Over 30 Years of Service in Industrial Air Engineering
DEPT. CA-46, 6 E. 45th St, NEW YORK, 17, N. Y.
Field Engineering Offices in Principal Cities

INDUSTRIAL COOLING • HEATING • DRYING
NIAGARA
HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Industrial Literature

Under the trade name Airfuge, the Swartwout Company, 18511 Euclid Avenue, Cleveland 12, Ohio, is offering a new separator for removing moisture, oil, scale, etc., from compressed air. It operates on the centrifugal principle. Bulletin S-13 describes it and is available from the company.

Detailed information on how to select power brushes has been issued in bulletin form by The Osborn Manufacturing Company, 5401 Hamilton Ave., Cleveland 14, Ohio. Discussion, tables, and illustrations cover all the principal points on which a choice should be based. Copies of the bulletin are available without cost.

Lebanon Steel Foundry, Lebanon, Pa., produces five grades of straight chromium-stainless steel castings with chromium contents ranging from 12 to 30 percent. They are designed for machinery handling nitrocellulose, nitric and certain other acids, nitrated compounds, juices, and mine waters. They are described in a new folder.

A new folder, *Hastelloy Facing for Corrosion Resistance,* tells of new processes for protecting chemical-plant and oil-refinery equipment from corrosion. It describes two ways by which Hastelloy can be applied to only those surfaces that are exposed to corrosive agents, thus obviating the current practice of making up entire assemblies of Hastelloy alloys. Copies of the folder may be had from Haynes Stellite Company, Kokomo, Ind.

A new catalogue of air-powered devices is offered by Mead Specialties Company, 4120 North Knox Ave., Chicago 41, Ill. It describes and illustrates presses, vises, collet fixtures, work holders, feeders, filter and pressure regulators, hand- and foot-control valves, and manifolds for distributing compressed air. Approximately half the space is devoted to sixteen different types of air cylinders.

New steel valves in the Hancock line made by Manning, Maxwell & Moore, Inc., of Bridgeport, Conn., and Boston, Mass., are claimed to represent "the most outstanding advancement in steel valve construction in 25 years." The new design is marketed under the name of Weldvalve and is available in gate, globe, and angle types and for pressures in the 600-to-2500-pound range. An illustrated descriptive catalogue may be had on request.

Catalogue No. 84 of the Logansport Machine Co., Inc., Logansport, Ind., covers that firm's line of Rotocast hydraulic cylinders for pressures up to 1500 pounds per square inch. The name is derived from the fact that the cylinders are made of centrifugally cast gray iron. The cylinders are designed for operation with oil, but water may be used if certain conditions are complied with. The catalogue describes cylinders arranged for seven standard types of mounting and gives engineering data on all of them.

The Gregory Tool & Manufacturing Co., 5300 Tireman Ave., Detroit 4, Mich., makes hammers that are designed for delivering light taps and controlled blows. These tools, which are called "soft" hammers, have application in various industrial, commercial, and professional fields ranging from medical therapy to shipbuilding. The tips are made of copper, brass, plastic, or any combination of them. The hammers come in twelve models and 56 head sizes, ranging from ¾ to 2½ inches in diameter and from 3 ounces to 10½ pounds in weight. Descriptions and prices are given in a free 6-page bulletin.

"VIC" VICTAULIC SAYS...

"Pipe fitting ain't what it used to be... No sir!"

"There's no need today for bulling pipe with heavy tongs and other back-breaking, time-consuming operations. You can "button up" your lines with Victaulic Couplings.

"They're simplicity itself . . . and fast. A socket wrench is the only tool. Only two bolts to make up . . . and they're always accessible.

"Victaulic makes fittings too . . . elbows, tees, etc. . . . of every type. They're handy, believe me. Swivel and set 'em at any angle . . . no bolt holes to line up.

"Best of all, Victaulic systems are tight. If you're not convinced, ask a Victaulic user in any field of industry.

"Believe me, we *know* Victaulic Couplings and Full-Flow Fittings can help you. Find out how... now!"

Write for new Victaulic Catalog and Engineering Manual

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30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Victaulic, Inc., 727 W. 7th St., Los Angeles 14, Calif.
Victaulic Company of Canada, Ltd., 200 Bay St., Toronto
For export outside U. S. and Canada: PIPECO Couplings and Fittings: Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

Have you considered Victaulic for your piping requirements?
Sizes — ¾" through 60"

SELF-ALIGNING PIPE COUPLINGS
VICTAULIC
EFFICIENT FULL-FLOW FITTINGS

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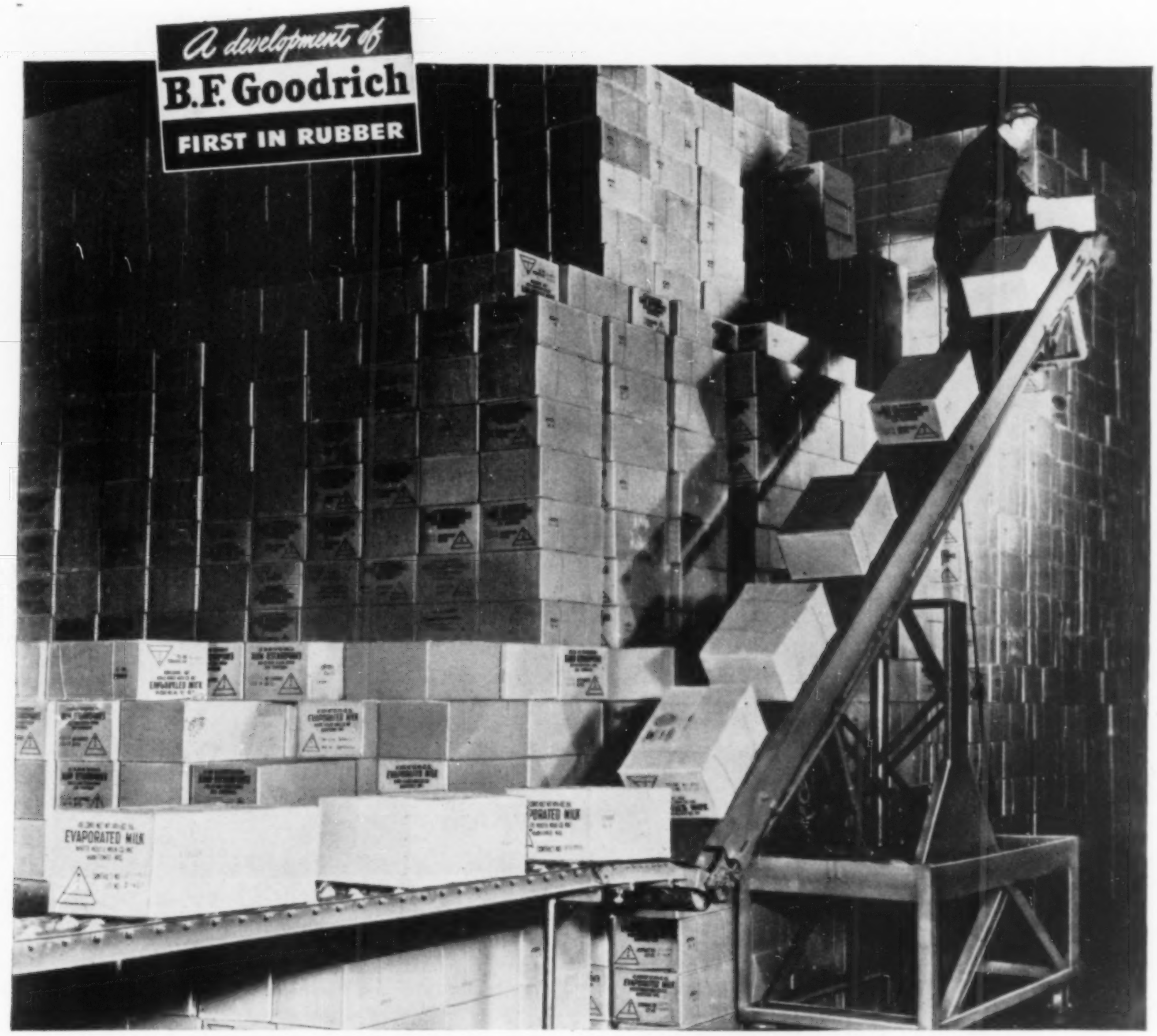


Rubber fingers move a mountain of milk

A typical example of B. F. Goodrich product development

THE higher the better — that's the way the warehouse operator felt about thousands of cases of evaporated milk that had to be stacked in the warehouse. The higher the stacks, the more goods can be stored in a given floor space.

But the height has always been limited by the stacking equipment. Belt conveyors have long been used. But the smooth surface of the conventional belt would hold boxes only when the incline was slight — too steep a pitch and the boxes slipped down the conveyor.

The company that manufactured the machine in the picture, a "Rapid Power Booster" (T. M. Reg.), came to B. F. Goodrich and found that they had already developed a belt — called Griptop — for handling bags of sugar, that grips the bags with thousands of tiny rubber fingers. A trial belt was installed on a Power Booster and carried cartons up a *35 degree grade.*

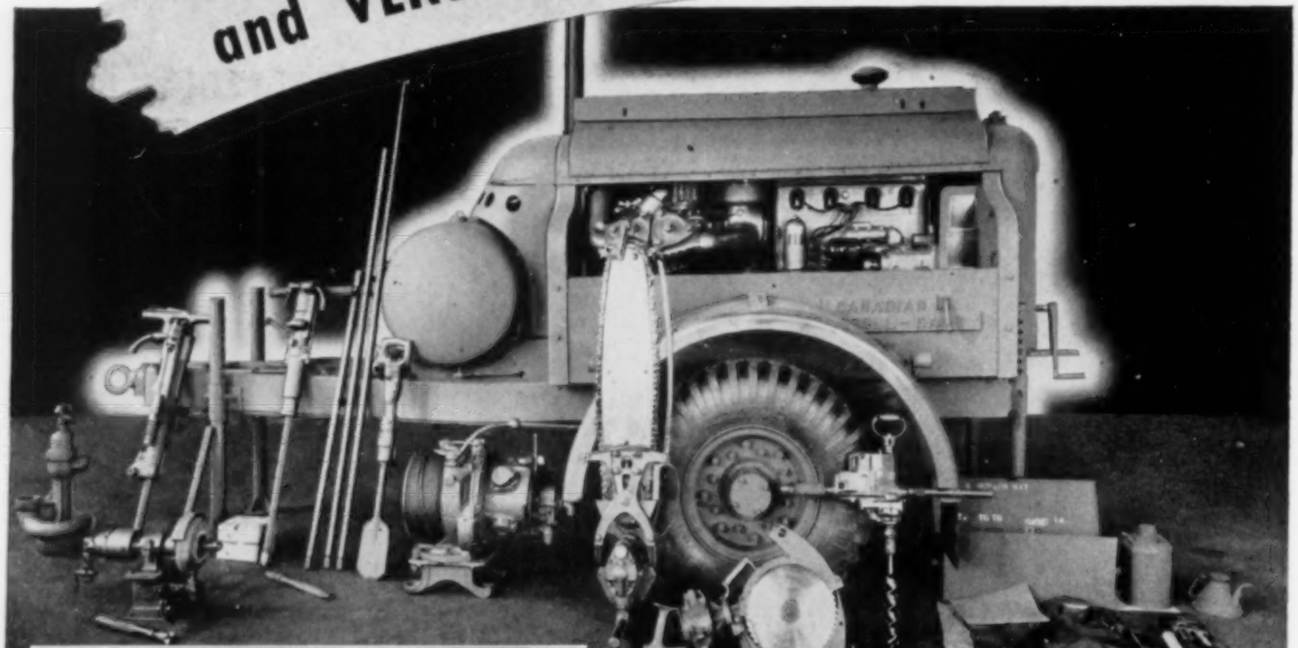
Thousands of these belts are in use today, carrying bags, boxes, cartons, baggage, coal, even ice — up grades that couldn't even be attempted with smooth surfaced belts. Like the 35,000 other B. F. Goodrich industrial products, their sole purpose is to increase efficiency and economy for American industry. Ask your B. F. Goodrich supplier for help with any problem that involves the use of rubber. *The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

B. F. Goodrich

RUBBER *and* SYNTHETIC *products*

WAUKESHA-POWERED

AIR TOOLS for MOBILITY and VERSATILITY on all fronts...



Air tool used by Royal Canadian Engineers—a Waukesha Engine powered Canadian Ingersoll-Rand Portable Air Compressor, complete with auxiliary equipment including chain saw for felling trees, power hand saw for heavy timber construction, air operated auger, grinding stand and sump pump.

●

Making repairs at battle front—Royal Canadian Engineers using an air hoist, mounted on tree trunk, to pull a drag scraper.

Overseas Photo Courtesy of Department of National Defense (Canada)

Compressed air was "ammunition" for the front-line Royal Canadian Engineers who repaired damaged bridges and constructed new ones, built roads, landing fields and advanced bases. *Waukesha-powered* Canadian Ingersoll-Rand Portable Air Compressors give their pneumatic tools the mobility and versatility so vital to battle-winning efficiency.

The Waukesha Engine and the compressor are joined in a single unified assembly—for complete reliability. All the advantages of multi-cylinder power—quicker acceleration, clean combustion, cool valves and fuel economy with more power—are built into this compact, sturdy, 4-cylinder Waukesha Engine.

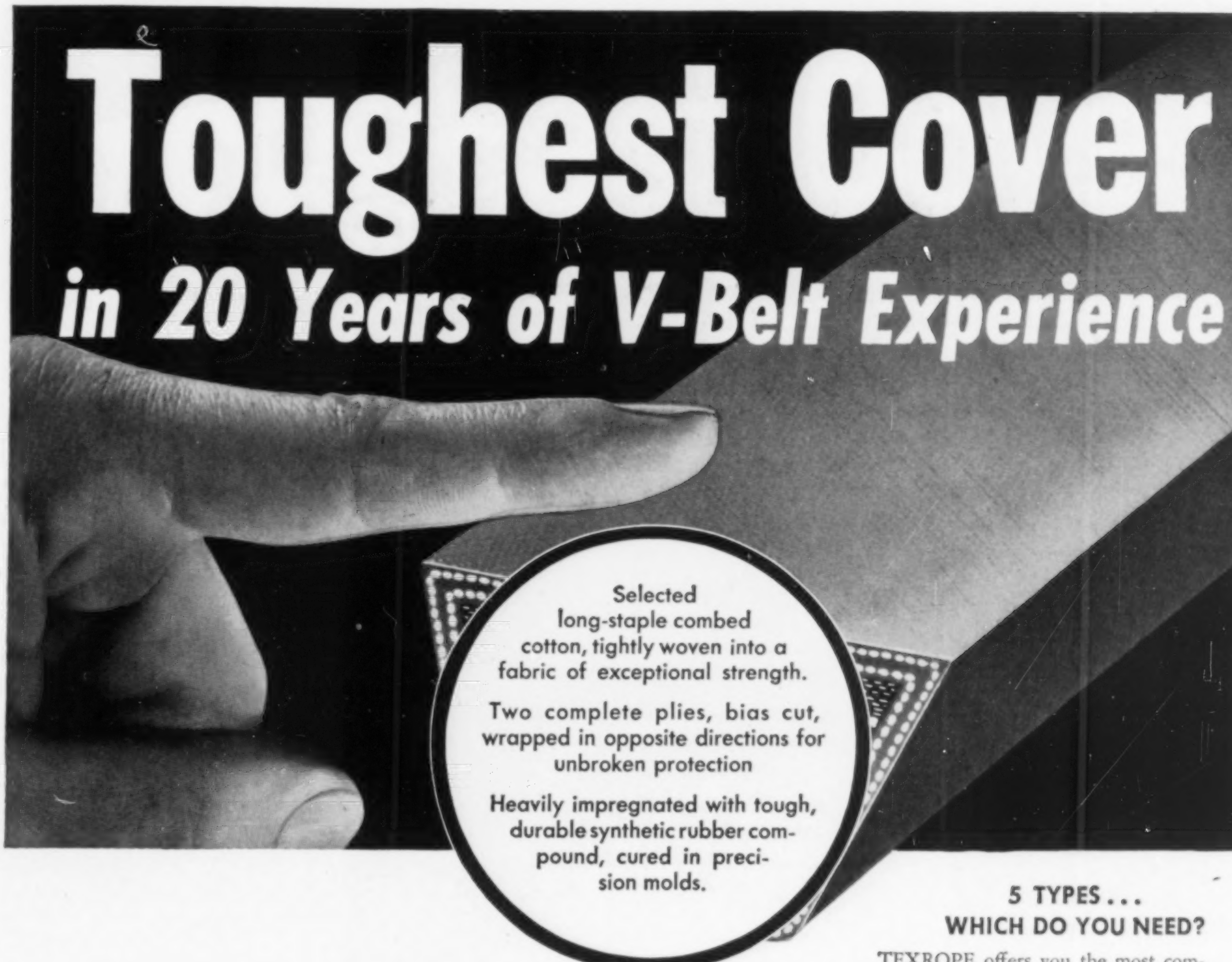
This Waukesha-powered equipment is now ready for peacetime work . . . building bridges and highways, tamping ties, municipal street maintenance, and all construction contractors' projects.

Waukesha Engines . . . gas, gasoline or diesel fuel . . . for shovels, cranes, hoists, pavers, mixers, graders, surfacers, tractors, or any peacetime industrial power-machinery are available now. Consult Waukesha about *all* your engine needs.

Get Bulletin 1377.

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.
NEW YORK • TULSA • LOS ANGELES

WAUKESHA ENGINES



Toughest Cover in 20 Years of V-Belt Experience

Selected long-staple combed cotton, tightly woven into a fabric of exceptional strength.

Two complete plies, bias cut, wrapped in opposite directions for unbroken protection

Heavily impregnated with tough, durable synthetic rubber compound, cured in precision molds.

Allis-Chalmers Builds Longer Life Into Famous TEXROPE V-Belts

A V-Belt is no better than its COVER. And . . . TEXROPE Super-7 belts today carry the toughest, most wear-resistant cover that Allis-Chalmers has developed since they invented the Multiple V-Belt Drive! It's the result of 20 years of continuous research and improvement.

This tough, resilient sheath is unbroken and unweakened by grooves or serrations. It takes the wear, holds the belt in shape, protects the load-carrying core structure.

Added Strength — Smoother, Cooler Running

50% Stronger Cords, impregnated with friction-fighting gum rubber. *War-proved Buna-S,* better, cooler-running than natural rubber. *Perfect Balance,* every belt accurately proportioned, precision molded to run true and cool. Make Allis-Chalmers your V-Belt headquarters! ALLIS-CHALMERS, Milwaukee 1, Wisconsin.

A 2003

5 TYPES . . . WHICH DO YOU NEED?

TEXROPE offers you the most complete line of V-Belts — types specially developed to meet ALL operating conditions. Pick the right TEXROPE Super-7 V-Belt — it'll give you the most in efficient power transmission.

Heat-Resisting Super-7
Stands temperatures up to 180°. The TEXROPE V-Belt for most drives.

Oil-Resisting Super-7
Neoprene cover protects core against moderately oily or greasy conditions.

Oil-Proof Super-7
Made of Neoprene throughout. Use it when the belt must swim in oil.

Static-Resisting Super-7
Recommended where explosion hazard exists. Static-conducting element throughout cover won't wear off.

Super-7 Steel
Twin steel cables, to pull extremely heavy loads with minimum stretch.

GET THEM — through your Allis-Chalmers district office or dealer.

TEXROPE Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich — and are sold exclusively by A-C.

V-BELTS
TEXROPE complete line — Sizes, types for every power transmission problem and condition.

ALLIS-CHALMERS
TEXROPE V-BELT DRIVES
ORIGINATORS OF THE MULTIPLE V-BELT DRIVE

SHEAVES
"MAGIC-GRIP" . . . TEX-STEEL . . . TEXDRIVE . . . Speed changers and VARI-PITCH sheaves.

HEAR THE BOSTON SYMPHONY *Every Saturday Evening, American Broadcasting Co.*

The Meaning of
"Years Ahead"
Design
85-B

IMPORTANT new designs and improvements are rarely the results of good luck; most of them come the hard way, from intensive research by skilled engineers working with ample facilities and a thorough knowledge of the field. That's especially true of mining shovel design, where so much depends on constant close contact with current field problems, on engineers with the "know how" to develop practical ways to solve those problems, on manufacturing facilities extensive enough to permit really progressive design. To these must be added an ever-present determination to build the finest possible equipment; to consider thoroughly suggestions and recommendations from the men on the job, with the aim of steady improvement.

Bucyrus-Eries are "years ahead" because they are scientifically designed and built to fit the exact needs of the men who will use them, the men to whom "years ahead" design means the most in dollars and cents.

3L45

BUCYRUS ERIE

SO. MILWAUKEE WISCONSIN

FOR ALL THESE SERVICES...

HOT AND COLD WATER circulating systems

BOILER FEED LINES

STEAM RETURN LINES

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LOW AND HIGH PRESSURE AIR piping systems

LUBRICATING OIL circulating systems where filters and coolers are used.

INDUSTRIAL GAS piping, such as oxygen, nitrogen, argon, helium, etc. throughout laboratories.

SOLVENT PIPING carrying solvent into process and away from process through recovery equipment.

VACUUM PIPING systems

Cut away view of a Walseal Tee showing ring of silver brazing alloy and completed Silbraz* joint.

specify SILBRAZ★ JOINTS

MADE WITH WALSEAL* PRODUCTS

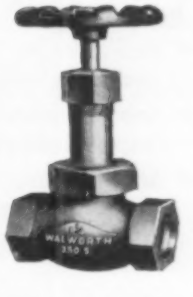
Yes, on tough jobs like these, where brass or copper pipe or copper tubing is used, Walseal bronze valves, fittings, and flanges do a two-fold job.

1. They make leakproof, trouble-free connections that are permanent . . . vibration-proof, corrosion-resistant — connections that will not creep or pull apart; that literally join with the pipe to form a "one-piece pipe line."

2. They eliminate the need for maintenance and costly repairs — especially important where lowered operating costs are imperative.

For these reasons more and more piping installations are being made with the modern Silbraz joints, using Walseal products. For complete details on Walseal products, write for a free copy of Walworth Circular 84.

No. 95WS — 150-Pound Bronze Globe Valve with Renewable Disc, Lock-on Disc Holder, and Walseal Ends.



No. 225PWS — 350-Pound Bronze Globe Valve with "500 Brinell" Plug Type Seat and Disc, and Walseal Ends.

Walworth also manufactures a complete line of bronze, iron, and steel valves and fittings. A detailed description of the entire line is included in Catalog 42. Write for your free copy today.

*Patented—Reg. U. S. Pat. Off.

Make it a "one-piece pipe line" with WALSEAL

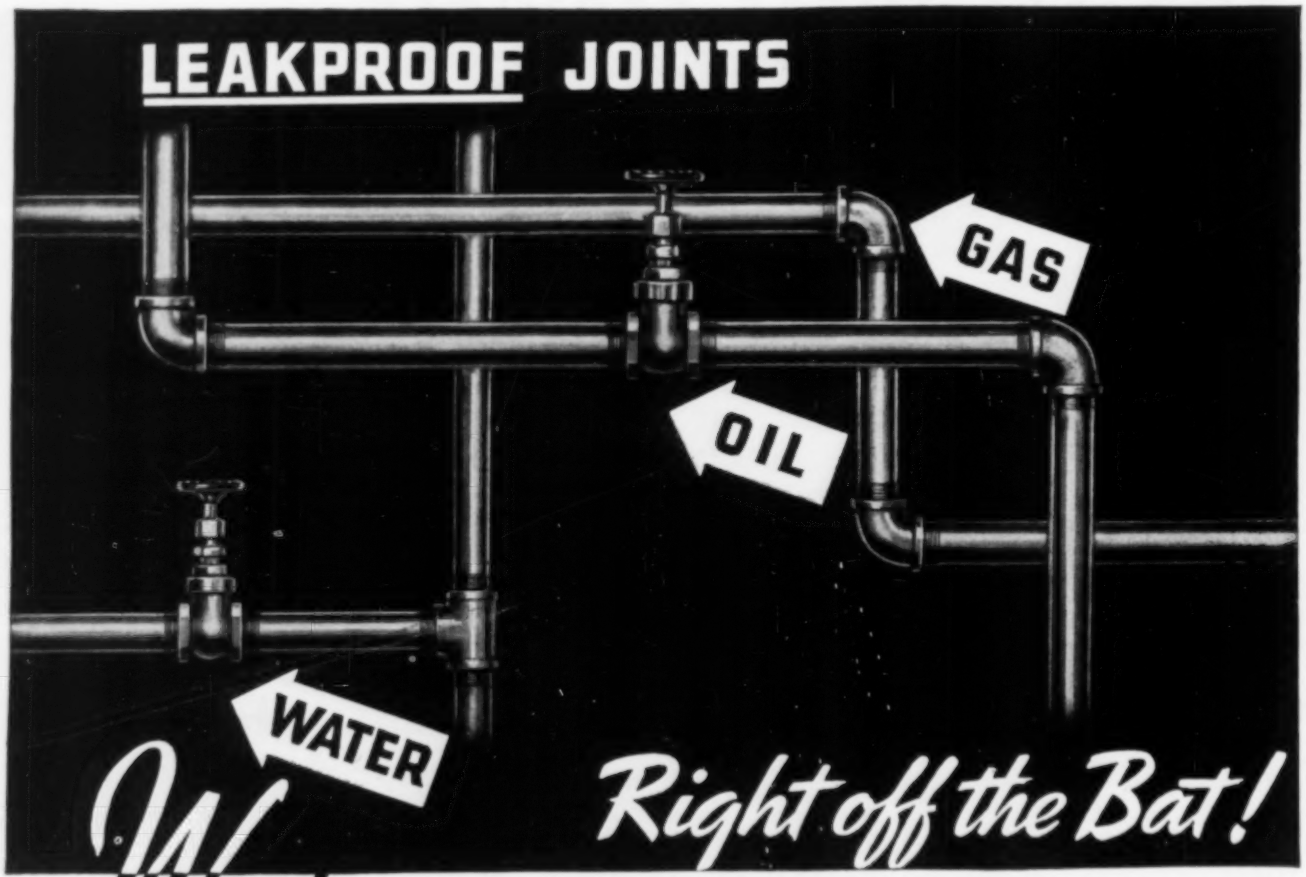
WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

LEAKPROOF JOINTS


GAS
OIL
WATER

Right off the Bat!

With JOHN CRANE

Insoluble PLASTIC LEAD SEAL

√ CHECK THESE ADVANTAGES

- *Insoluble* in water, gasoline, freon, ammonia, CO_2, propane, etc. Will not wash out.
- *Seals quickly and permanently;* fills all clearances and imperfections.
- *Stops galling and rust.* Never hardens; joints are easy to take apart years later.
- *Ready for use.* Packed in 1, 5 and 7 lb. cans.

JOHN CRANE
INSOLUBLE
PLASTIC
LEAD SEAL
FOR SEALING THREADS, GASKETS
ON ALL EQUIPMENT
NET WEIGHT 7 LBS.

ORDER A TRIAL CAN!

Watch Plastic Lead Seal save *time and reduce maintenance* costs in your plant or product.

CRANE PACKING COMPANY

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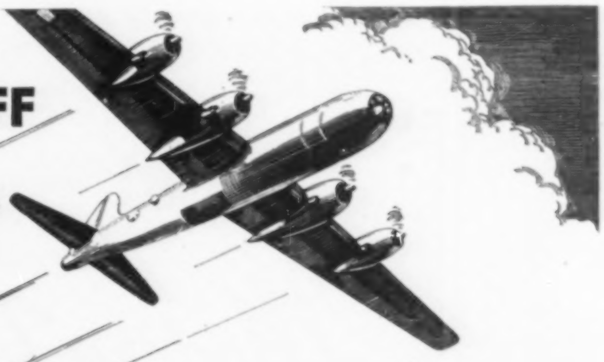
CRANE PACKING CO., LTD., Hamilton, Ontario, Canada.
Branches: Montreal, Toronto, Vancouver

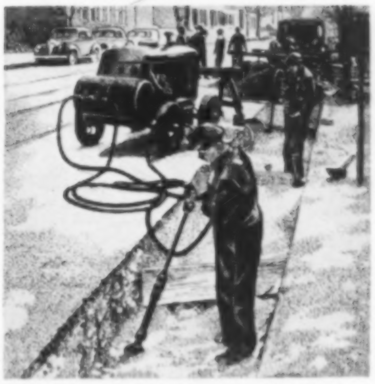
GET YOUR NEW JOBS OFF to a Flying Start WITH IR AIR POWER



$7,500,000,000 is the estimated minimum expenditure for the construction and maintenance of roads and streets in the next four years.

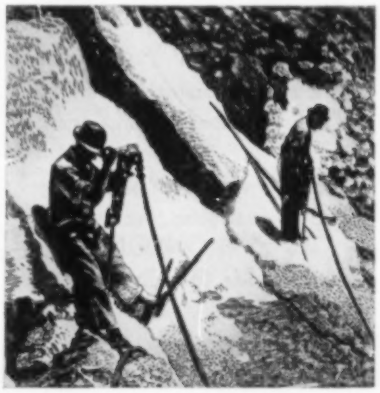
There will be many new jobs, and competition for them will be keener than ever before. That is why you will need the best rock drilling equipment available—that is why you will want Ingersoll-Rand.

In addition to outstanding performance, you also will receive the benefits of Ingersoll-Rand service and experience.

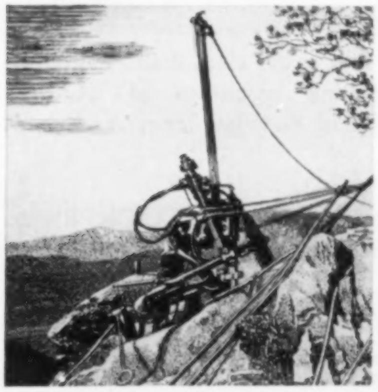


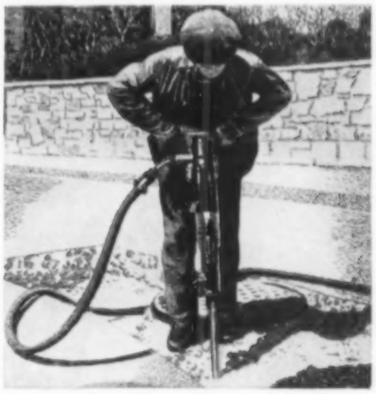
Backfill tampers, diggers and other pneumatic tools will save time and money on small jobs.

There's an easy-holding, fast-drilling Jackhamer for every job.



I-R wagon drills are noted for flexibility and deep-hole drilling power.

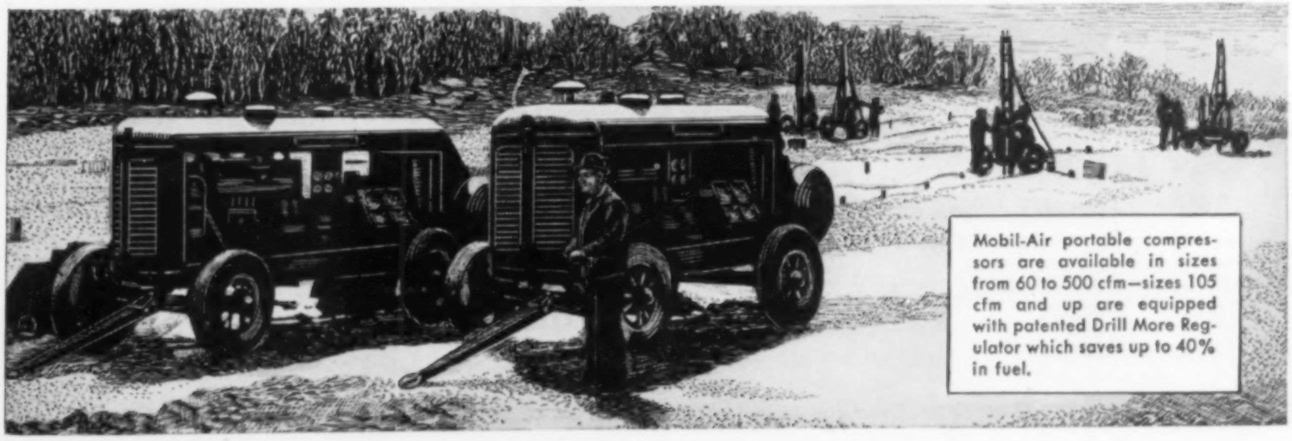




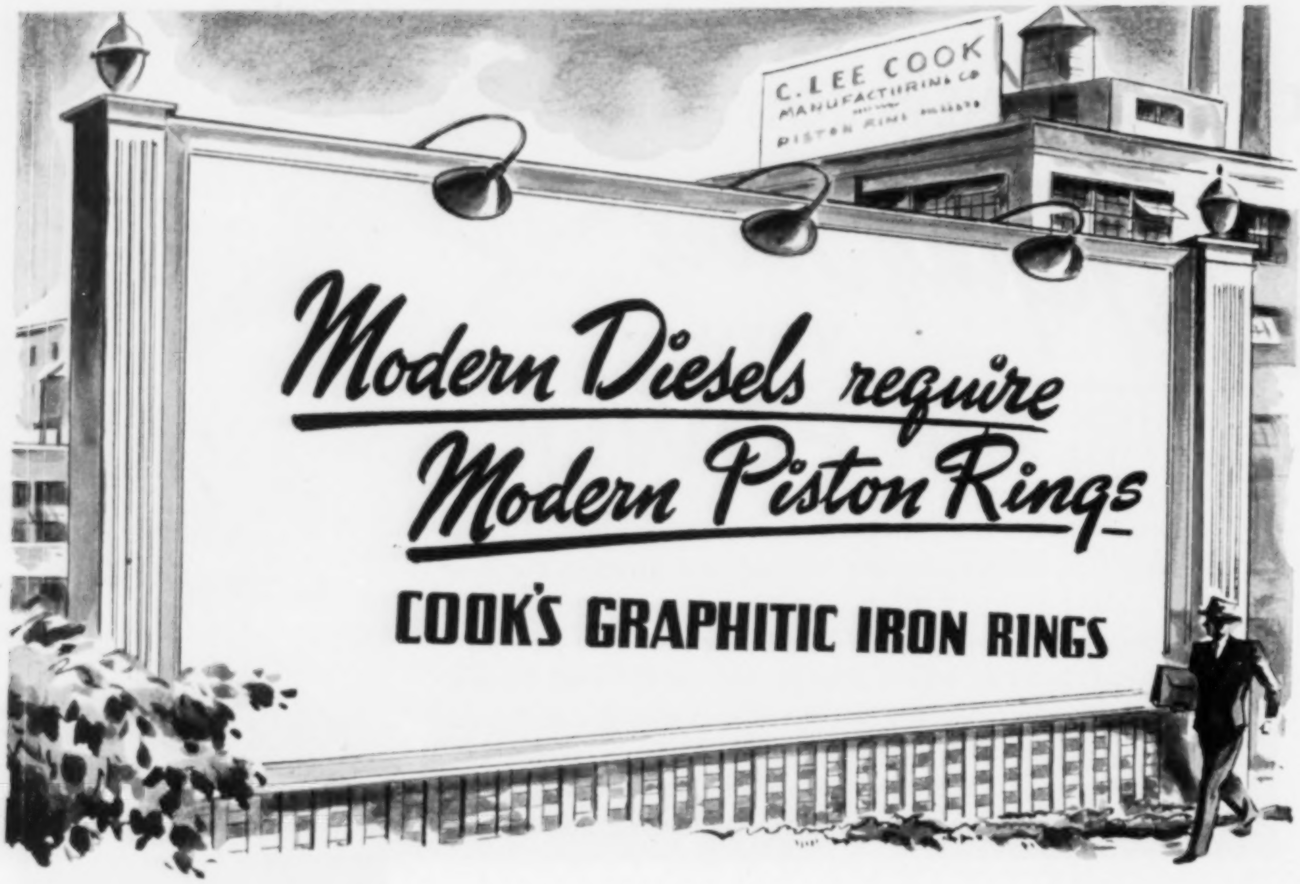
Cushioned-Air Paving Breakers have established records for hitting power and dependability.

Ingersoll-Rand

11 Broadway, New York 4, N. Y. 14-851



Mobil-Air portable compressors are available in sizes from 60 to 500 cfm—sizes 105 cfm and up are equipped with patented Drill More Regulator which saves up to 40% in fuel.



TODAY'S modern Diesels are high-output engines—the added horsepower is obtained by higher B.M.E.P.—this throws extra work on both cylinders and piston rings.

If your engine is of industrial size and falls in this class, it will pay you to investigate the superior wear-resisting properties of COOK GRAPHITIC IRON Rings—you will find they last longer and give added life to cylinders.

You will find this to be true because the material in COOK Rings originally was developed to meet the demands of extreme pressures and "boundary lubrication".

Results have been proven time and again in both laboratory and field tests, but the most convincing test is provided by the thousands of installations that have served dependably for years.

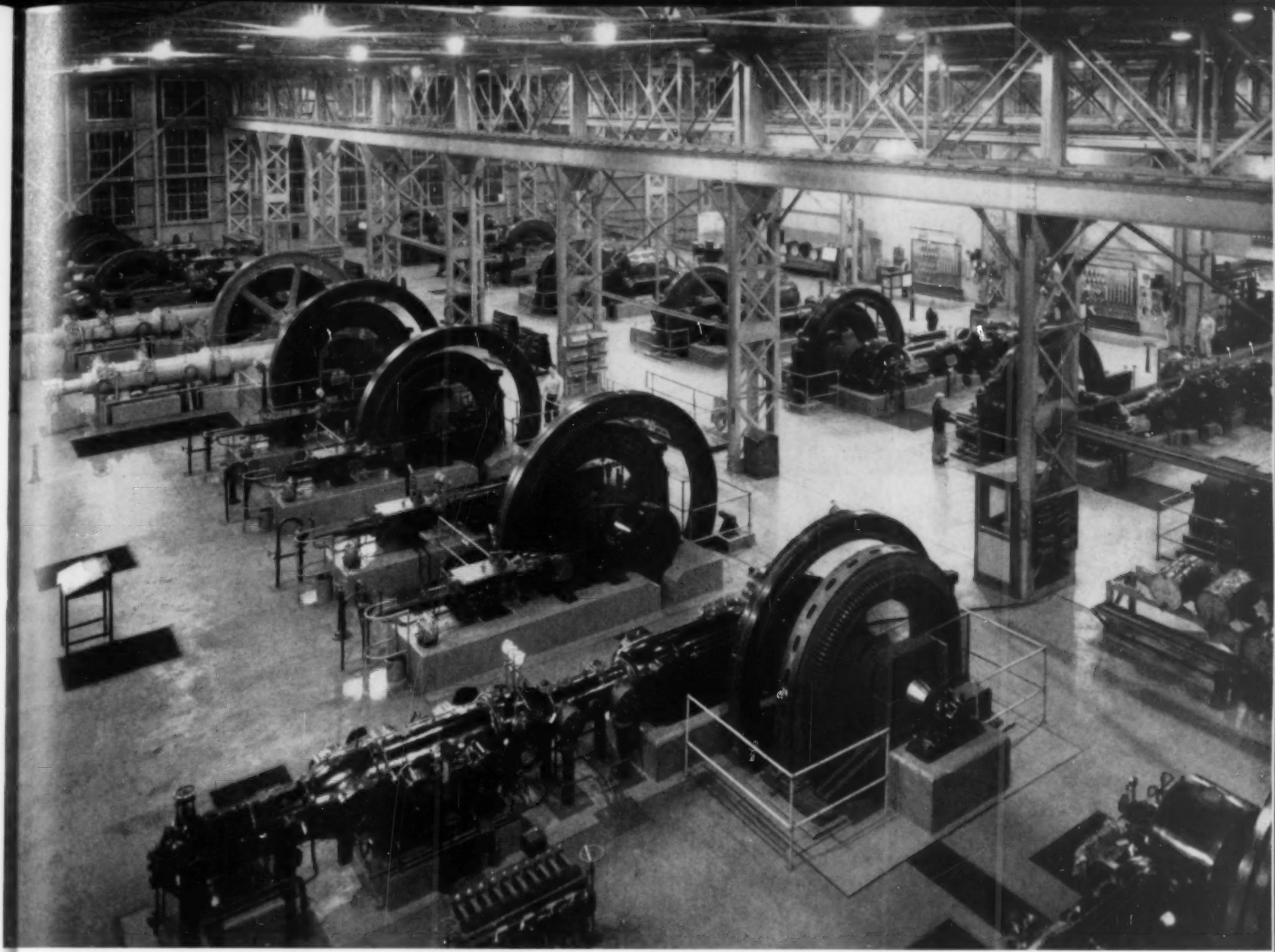
Constantly refined since first introduced over 20 years ago, COOK Rings are available in all conventional styles and many exclusive designs. For factory equipment, ask our engineers to study your problem. For replacement, address nearest branch office.

COOK'S GRAPHITIC IRON
Piston Rings

Sealing Pressures Since 1888

C. LEE COOK MANUFACTURING CO.
INCORPORATED
LOUISVILLE KENTUCKY

BALTIMORE • BOSTON • CHICAGO • CLEVELAND • HOUSTON • LOS ANGELES • MOBILE • NEW ORLEANS • NEW YORK • SAN FRANCISCO • TULSA



NITROGEN SQUEEZE-PLAY!

With 25,000 Horsepower of E-M Synchronous Motors driving huge compressors, Shell Chemical, Div. Shell Union Oil Corp., squeezes nitrogen into ammonia at synthesis plant

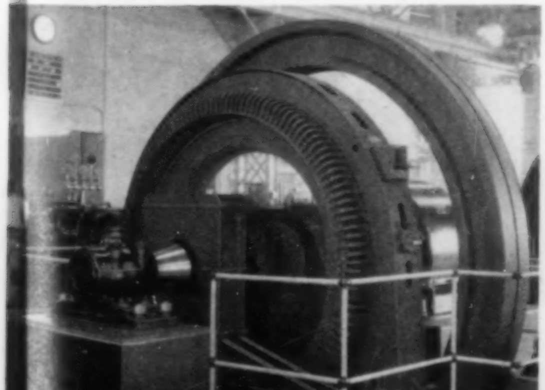
ONE of Nature's amazing paradoxes is the ability of the element Nitrogen both to preserve and to destroy life. Combined with hydrogen, it forms pungent-smelling *ammonia* . . . the basis for fertilizers, and mixed with nitric acid forms an explosive.

At the Shell Company's plant, Shell Point, California, these huge synchronous-motor-driven compressors furnished the squeeze for nitrogen fixation to make synthetic ammonia for war's explosives. Now, with swords turning into plowshares once again in peace, this pioneer manufacturer of synthetic ammonia is helping to meet the agricultural needs of the country with ammonia for fertilizers.

The great amount of motor power for driving the compressors that squeeze the gases to high pressures for synthesis . . . some 15,000 horsepower in the original installation, plus an additional 10,000 horsepower during the war . . . is provided by E-M Synchronous Motors. Ranging from 50 to 1000 h.p. each, these motors were designed to meet the vital requirements of (1) *High Efficiency* to minimize cost of electricity in operating the compressors; (2) *High Power Factor* for maximum electrical system effectiveness and economy; (3) *Direct-Drive* for simplicity and a minimum of maintenance; (4) *High Stability* to keep motors going despite momentary voltage dips that might occur.

You can put these synchronous motor advantages to work for you in your plant too! Let the E-M field engineer help you to motorize *profit-wise* with synchronous motors.

A-2027



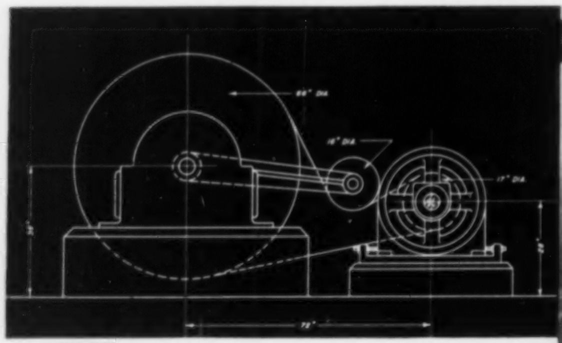
Typical of E-M's Synchronous Motor engineering skill, was the special design to provide the right motor torque and stability characteristics for the large flywheel effect (WK^2) required by some of the high-pressure tandem compressors, such as the unit shown at left.

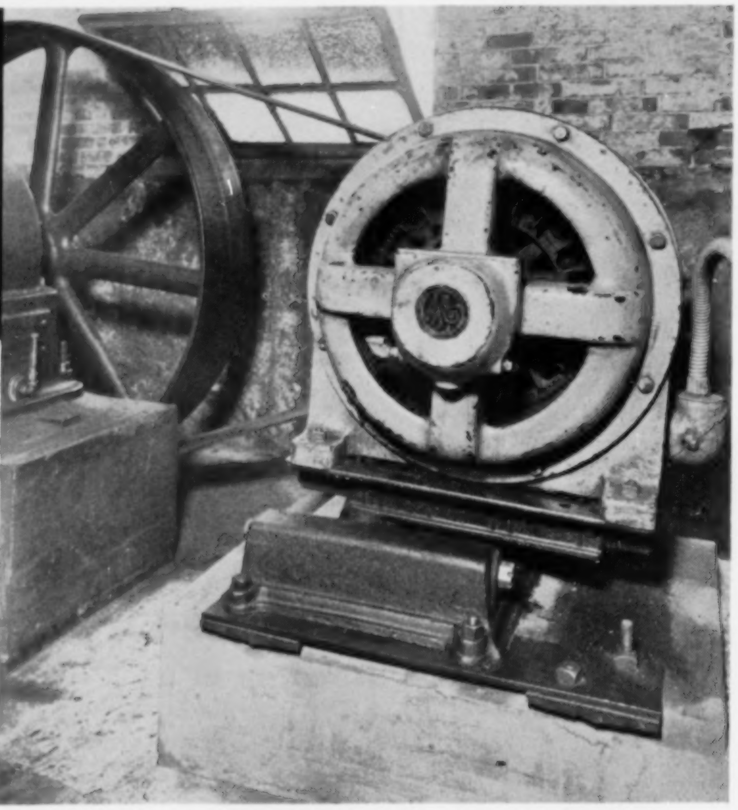
MOTORIZE PROFIT-WISE
WITH SYNCHRONOUS MOTORS

E-M

ELECTRIC MACHINERY
MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

When Driving Compressors, Use F.L.A.T.





NOT THIS ⬆

BUT THIS ➡

The Flat Leather Automatic Tension drive, utilizing a pivoted motor base and Graton & Knight's Research Leather Belt, does away with inefficient idlers which are harmful to the belt and expensive to maintain.

The pivoted base automatically regulates the belt tension and eliminates the harmful reverse belt flexing caused by the idler.

The Research belt, because of special processes used in its manufacture, hugs the small pulley and delivers maximum power to the driven unit.

The F.L.A.T. drive will give you relief from high maintenance costs and will result in more efficient compressor operation.

For full details write Graton & Knight Company, 365 Franklin St., Worcester 4, Mass. for Selection and Application Manual.

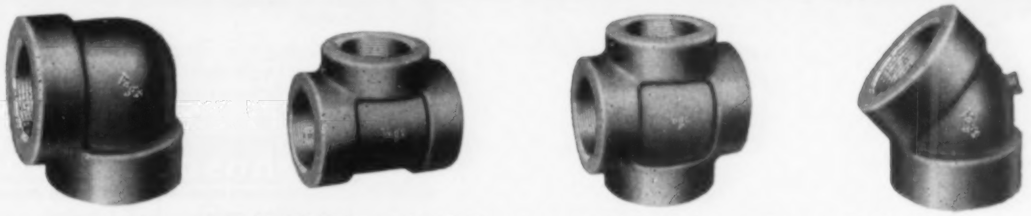
GRATON AND KNIGHT

Research Leather Belting

The most complete line . . . manufactured under one control from green hide to finished product. Graton & Knight distributors are listed under "Graton & Knight" in "Belting" section of Classified Telephone Directory and THOMAS' REGISTER.

STRENGTH

for Safety and Long-Time Service



For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SCREW END TYPE

For schedules 40, 80 and 160 pipe — Sizes 1/8" to 4"

SOCKET WELD TYPE

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-8 will aid you in their selection and proper application.

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy in steam plants, petroleum refineries, chemical plants and related industries.

HENRY VOGT MACHINE CO., INC.
Louisville 10, Kentucky
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

Vogt
Vogt FOR BETTER FITTINGS

DROP FORGED STEEL FITTINGS

Keep 'em Humming

Deliver full volume of power to all hydraulic and pneumatically controlled machinery . . . any operating conditions.

★ **HOSE**—synthetic rubber, reinforced with two layers of braided high tensile steel wire. Resistant to wear and rough handling. Impervious to heat and cold; oil and grease. Flexes almost indefinitely without failure. Won't swell or shrink; rot or slough off to clog the machine.

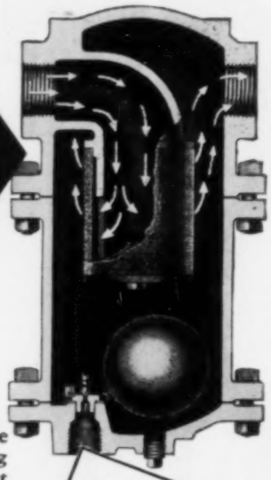
Use NORGREN INDUSTRIAL HOSE ASSEMBLIES

Limber as a Lariat - Strong as Steel

COUPLINGS—machined from brass bar stock. Stay-put regardless of vibration. Reusable couplings for low pressures; permanent couplings for high pressures. Assemblies available 1/4" to 1" I.D., any length.

Norgren

Write for Bulletin No. 450. **C. A. NORGREN CO.**
220 Santa Fe Drive, Denver 9, Colo.



NO MOISTURE OR DIRT GETS BY HERE

Johnson Self-Draining Compressed Air Separator . . . . . .

Like all Johnson Separators the new Type "SA" Self-Draining Separator combines the two most effective principles of removing moisture and dirt from compressed air:

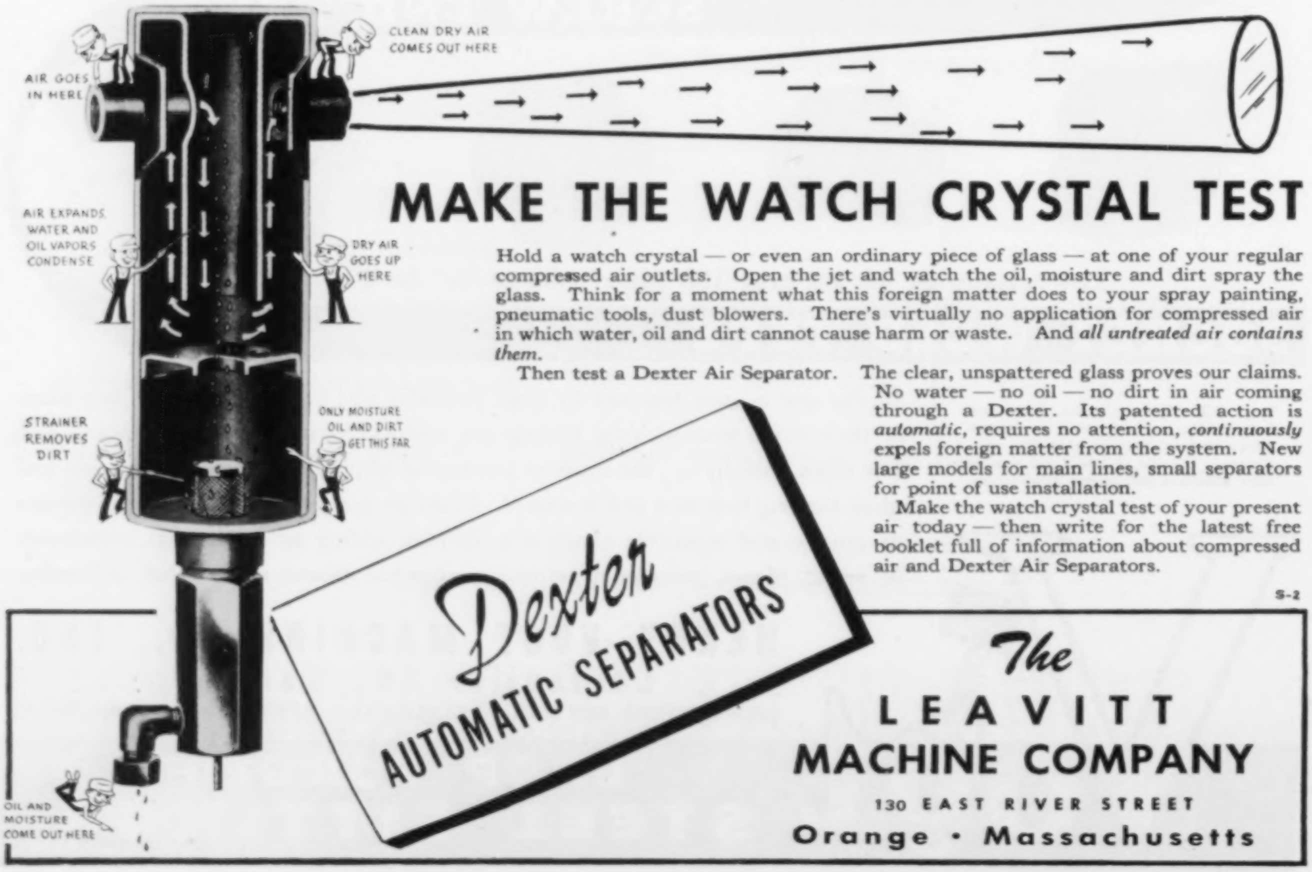
1. **Controlled expansion of air in separator precipitates most of the moisture.**
2. **A "thousand baffles" of coarse mesh repeatedly changes flow of direction to capture remaining foreign matter.**

Self-Draining—a simple but complete trap mechanism built right in, automatically drains separator whenever necessary.

Johnson Separation Devices include Separators for Compressed Air or Steam. After coolers, oil absorbers.

WRITE FOR CATALOG

The Johnson Corporation
830 WOOD STREET THREE RIVERS, MICH.


CLEAN DRY AIR COMES OUT HERE
AIR GOES IN HERE
AIR EXPANDS WATER AND OIL VAPORS CONDENSE
DRY AIR GOES UP HERE
STRAINER REMOVES DIRT
ONLY MOISTURE OIL AND DIRT GET THIS FAR
OIL AND MOISTURE COME OUT HERE

MAKE THE WATCH CRYSTAL TEST

Hold a watch crystal — or even an ordinary piece of glass — at one of your regular compressed air outlets. Open the jet and watch the oil, moisture and dirt spray the glass. Think for a moment what this foreign matter does to your spray painting, pneumatic tools, dust blowers. There's virtually no application for compressed air in which water, oil and dirt cannot cause harm or waste. And *all untreated air contains them.*

Then test a Dexter Air Separator. The clear, unspattered glass proves our claims. No water — no oil — no dirt in air coming through a Dexter. Its patented action is *automatic*, requires no attention, *continuously* expels foreign matter from the system. New large models for main lines, small separators for point of use installation.

Make the watch crystal test of your present air today — then write for the latest free booklet full of information about compressed air and Dexter Air Separators.

S-2

Dexter
AUTOMATIC SEPARATORS

The
LEAVITT
MACHINE COMPANY
130 EAST RIVER STREET
Orange · Massachusetts

MADISON-KIPP

Fresh Oil

DROP BY DROP UNDER PRESSURE

. . . from six popular models for every application. Madison-Kipp specializes in lubricators for original standard equipment. Write for special engineering data for your particular requirement. Lubricator illustrated is the Model FD End Rotary.

Fresh Oil DROP BY DROP UNDER PRESSURE FROM THE MODEL
CV
MADISON-KIPP LUBRICATOR
...VER DEVELOPED
Fresh Oil... BY THE MEASURED DROP
the most dependable method of lubrication ever developed
MODEL FD
MADISON-KIPP CORPORATION Madison 4, Wisconsin
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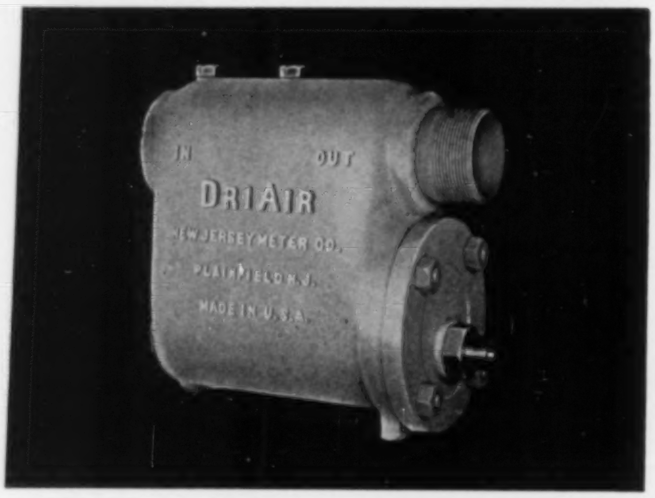
MADISON-KIPP CORPORATION
THE MOST DEPENDABLE METHOD OF LUBRICATION EVER DEVELOPED
Fresh Oil
DROP BY DROP from the
BULLETIN L-3501

MADISON-KIPP CORPORATION, 202 **Waubesa St., Madison 4, Wis., U. S. A.**

Sole Agent in England, Wm. Coulthard & Co., Ltd., Carlisle

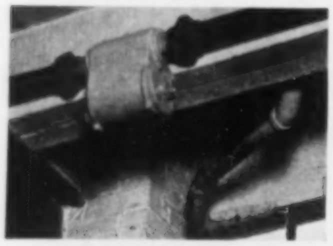
DEPENDABLE PNEUMATIC SERVICE


IN
OUT
DRIAIR
NEW JERSEY METER CO.
PLAINFIELD N.J.
MADE IN U.S.A.

WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

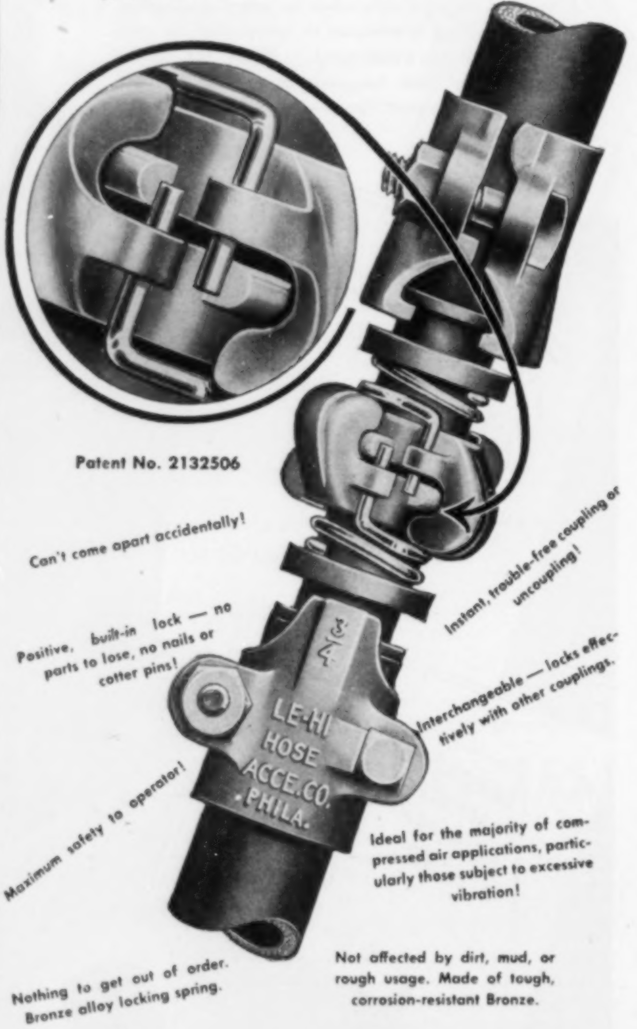
DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper – resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY
PLAINFIELD, NEW JERSEY

HERE IT IS!

LE-HI's patented "SAFETY-LOCK"

A REALLY SAFE UNIVERSAL TYPE HOSE COUPLING


Patent No. 2132506
Can't come apart accidentally!
Positive, built-in lock — no parts to lose, no nails or cotter pins!
Maximum safety to operator!
Nothing to get out of order. Bronze alloy locking spring.
Instant, trouble-free coupling or uncoupling!
Interchangeable — locks effectively with other couplings.
Ideal for the majority of compressed air applications, particularly those subject to excessive vibration!
Not affected by dirt, mud, or rough usage. Made of tough, corrosion-resistant Bronze.
3/4
LE-HI HOSE ACCE. CO. PHILA.

The new LE-HI Series 150-B "SAFETY-LOCK" Universal Type Hose Couplings will be ready soon in 3/8", 1/2", 3/4", and 1" sizes.

Write today for full information on these fast-selling, LE-HI "exclusives"!

SOLD ONLY THROUGH LEADING DISTRIBUTORS AND RUBBER MANUFACTURERS

"LE-HI" MAKES A GOOD CONNECTION

LE-HI
HIGH and LOW PRESSURE
HOSE COUPLINGS

HOSE ACCESSORIES COMPANY
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OPEN HEARTH & ELECTRIC STEEL
1963 ELMWOOD AVENUE
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Don't let relative humidity wreck your pneumatic tools!

100
10
90
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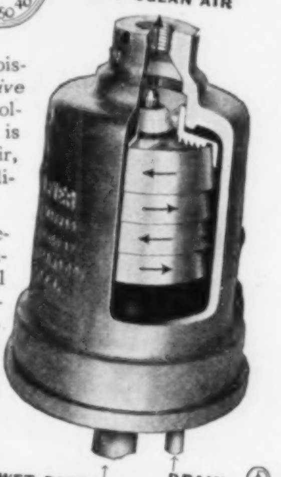


Even desert air contains moisture, and the higher the *relative humidity*, the more water collects in air lines when air is compressed. By compressing air, the water in the air is consolidated along with it.

The Aridifier effectively removes moisture from the compressed air lines by centrifugal force—dirt and scale, too. Completely protects air tools, controls, paint sprays, etc. Only device of its kind. Employs no traps, baffles, filters or porous stones. Thousands in use. For lines 3/8" to 10". Send for Bulletin 545.

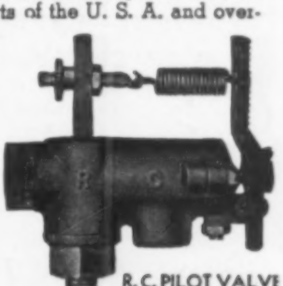
Logan Engineering Co.
4911 Lawrence Ave., Chicago 30, Ill.

REMOVES
OIL
WATER
DIRT

Logan ARIDIFIER
Dries and Cleans Compressed Air

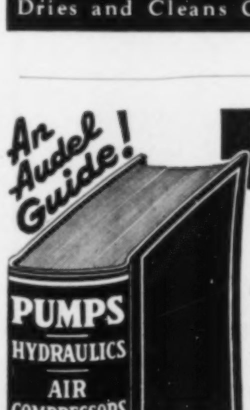
R. C. PILOT VALVES FOR POSITIVE CONTROL

R-C Unloader Pilot Valves (plain or strainer type) are standard on many leading compressors . . . installed as replacements on thousands of compressors in all parts of the U. S. A. and overseas. The R-C valve—positive in action—cannot chatter . . . it's always in open or closed position. Adjustment is provided for any unload-to-load range from 3% to 30% of maximum receiver pressure. Install an R-C Unloader Pilot valve—let performance prove its value. Specify air pressure and range of on-and-off operation desired. Write for price and recommendation.



R. C. PILOT VALVE
STRAINER TYPE

R. CONRADER CO.
1207 FRENCH STREET - ERIE, PA.
PILOT VALVES for Portable and Stationary Air Compressors provided with Unloaders



PUMPS-HYDRAULICS-AIR COMPRESSORS

JUST OUT! 3 BOOKS IN ONE—OVER 1650 PAGES, 1654 ILLUSTRATIONS, WITH QUESTIONS AND ANSWERS. COMPLETE PRACTICAL CONCISE INFORMATION FOR ALL ENGINEERS AND OPERATORS.

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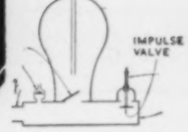

***PART 3*—AIR COMPRESSORS—406 Pages:** Compression of Air—Compressor Classification—Parts, Types—Inter and After Coolers—Regulating Devices—Installation—Lubrication—Operation—Maintenance—Blowers—Super-Chargers—Pneumatic Hand Tools—Ready Reference Index and Tables. 402 Illustrations.

Free Examination

TO GET THIS ASSISTANCE FOR YOURSELF SIMPLY FILL IN AND MAIL YOUR ORDER TODAY $4 COMPLETE PAY ONLY $1 A MO.

AUDEL, Publishers, 49 West 23 St., New York 10, N. Y.
Send postpaid AUDELS PUMPS, HYDRAULICS, AIR COMPRESSORS ($4). If I decide to keep it, I will send you $1 within 7 days; then remit $1 monthly until purchase price of $4 is paid. Otherwise, I will return it promptly.

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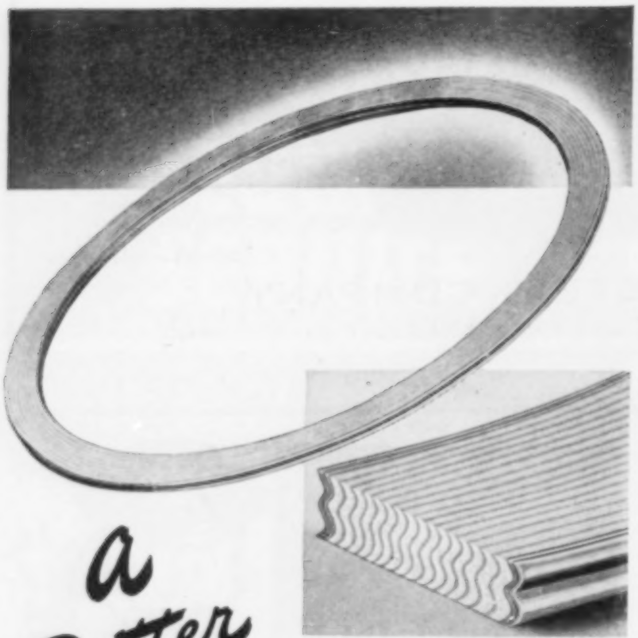
Occupation..

Employed by.................................... P-11



a Better gasket

Cross section view of Garlock *Guardian* gasket shows three points of resiliency of the metal strips which separate the layers of asbestos. Inner and outer edges of the gasket are reinforced with double thicknesses of metal, electrically welded for added strength.

RESILIENT—EXPANDS AND CONTRACTS WITH CHANGING TEMPERATURES

For a permanently tight joint under changing temperature conditions your gasket should be a Garlock *Guardian* gasket. This gasket combines extraordinary resiliency with great strength.

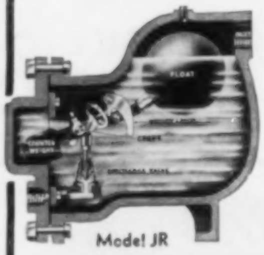
Because of its unique structural design it adjusts itself instantly and repeatedly to expansion and contraction of the pipe line or equipment.

Also *Guardian* gaskets withstand extreme temperatures and pressures and effectively resist the destructive action of gases and liquids.

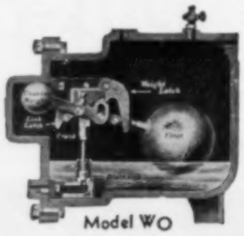
THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company
of Canada, Limited, Montreal, Que.

GARLOCK
Guardian
GASKET

FOR
FAST ACTION
SPECIFY
NICHOLSON AIR STEAM GAS **TRAPS**



Model JR



Model WO

Featuring rapid intermittent action with enormous drainage capacity, Nicholson weight-operated traps have been positively proved, in plants the nation over, to be dependable as efficiency promoters. Let us send you details. Nicholson also makes piston-operated and thermostatic steam traps, air, gas, gasoline traps - - for all power and process applications. Pressures to 1500 lbs.

Catalog 444

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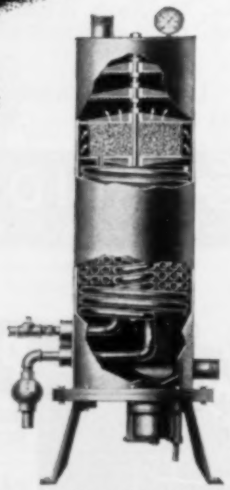
Valves ★ Traps ★ Steam Specialities

THIS IS THE MURPHY AFTERCOOLER-SEPARATOR-FILTER ★ GUARANTEED



YES...

Guaranteed, like all Murphy products, to do the job . . . and wear. Removes all moisture and oil from compressed air lines and delivers it to the point of use clean, cool and dry.

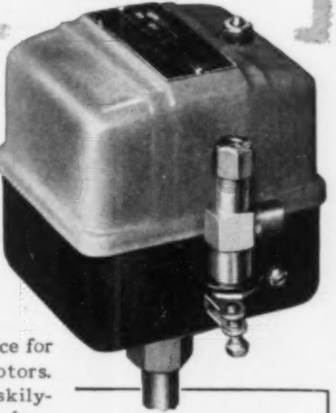
For complete description write for our A S F Bulletin.

Capacities
50 to 2000 CFFAPM
Sizes
1" to 4"

GUARANTEED COMPRESSED AIR PRODUCTS

AFTERCOOLERS • SEPARATORS • STRAINERS • TRAPS
SPRAY GUNS • PISTOL SPRAYERS
JAS. A. MURPHY & CO.
HAMILTON, OHIO, U.S.A.
Moisture Elimination Up To 3000 Pounds Per Square Inch

FOR AIR COMPRESSORS



class 9213AH3

PRESSURE SWITCH

200 lbs. pressure limit
15 to 40 lbs. differential

- A two-pole device for intermediate-sized motors. Simply-designed, huskily-built mechanism delivers long life and trouble-free operation with a minimum of servicing.

Quickly wired. Range and differential easily adjusted in the field. Offered with or without pressure-release valve for easier motor starting.

Write for Catalog • photos, specifications of Square D pressure switches and related devices. Address Square D Regulator Division, 6060 Rivard Street, Detroit 11, Michigan.

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New The **AIRFUGE**

The Whirl Does the Trick

AIRFUGE
THE
SWARTWOUT
COMPANY
CLEVELAND

cleans compressed air efficiently—saves your tools from corrosion, clogging or freezing

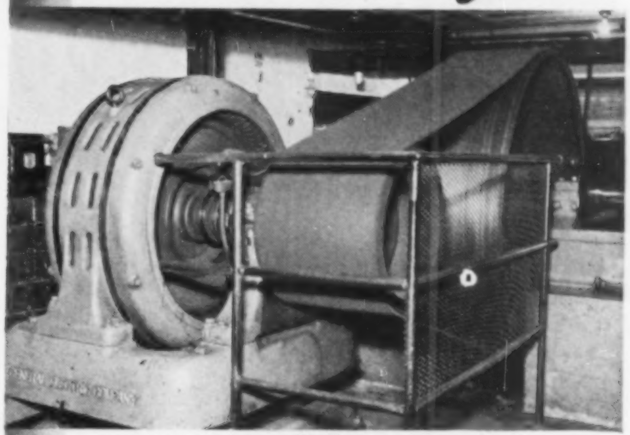
Simple Positive Low Cost

Removes impurities by centrifugal force. Operates continuously without attention — and without pressure loss. Write for Bulletin S-13, today

THE SWARTWOUT CO.
18535 Euclid • Cleveland 12, Ohio

AIRFUGE
AIR SEPARATOR AND TRAP

Minimize SHUTDOWNS–



with **SCHIEREN LEATHER BELTING**

ON A PIVOTED MOTOR BASE

Eliminate shutdowns and save precious man-hours! Cut out the time loss in frequent take-ups to compensate for stretch! Here's how: Simply combine SCHIEREN LEATHER BELTING— famous for quality for 76 years—with the constant, automatic, correct tension of a pivoted motor base on short center. SCHIEREN'S unsurpassed leather selection, tannage processes and belting workmanship assure the longest and finest belting performance. And that gives you less wear on bearings, smoother operation, and the utmost from your compressor.

Write for our estimate on your next drive. No obligation whatever.

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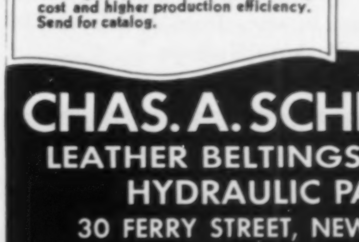

SCHIEREN QUALITY LEATHER PACKINGS for every usual and unusual requirement give you lower annual packing cost and higher production efficiency. Send for catalog.

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HYDRAULIC PACKINGS
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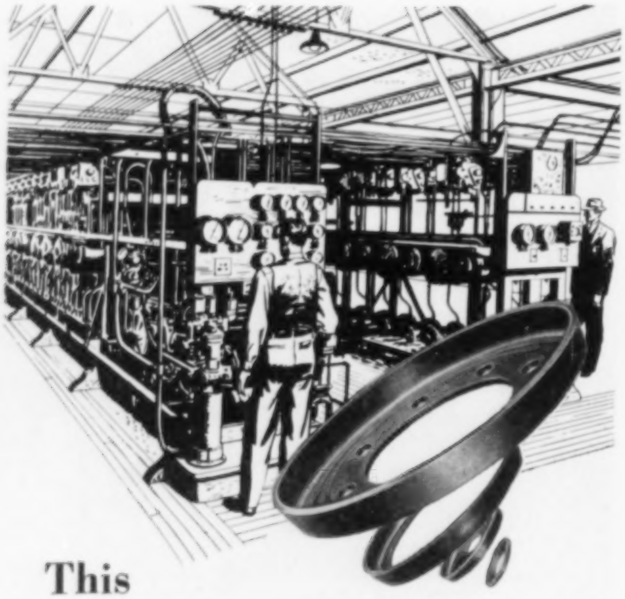

This "STATIONARY TRAIN" helped develop *Piston Packing Cups* that serve you better.

PRODUCTS today have to be designed for a *buyers* market . . . and the *extras* in service, in economy, and in freedom from maintenance will decide the sale. If your product utilizes pneumatic or hydraulic cylinders, you can add this margin by installing Wabco Piston Packing Cups.

The material for these cups was developed to meet the need for air brake cylinder packing that would stand desert heat or mountain cold, could get along with lubricants, and that would retain resilience and sealing properties for extended periods. Test equipment like the "stationary train" illustrated helped give the packing its initial check-up, but the most convincing test is provided by the hundreds of thousands of installations that have served dependably for years, on railroads all over the globe.

Wabco Piston Packing Cups are available for original installation in ¾-inch to 30-inch diameters for pneumatic cylinders and $1\frac{3}{16}$-inch to 7-inch sizes for hydraulic cylinders. The exclusive limited compression feature can be furnished in sizes from 1-inch to 7½-inches. Ask for Wabco Packing Bulletin.

Westinghouse Air Brake Co.
Industrial Division - - - Wilmerding, Pa.

COMPRESSED AIR LINE PURIFICATION YOUR PROBLEM?

Here's the Answer...

The new Bird-White Pur-O-fier A-1 assures you of positive elimination by turbo-rotor centrifugal action of all free moisture, oil and foreign matter in small compressed air or gas systems. It operates with from 1 to 5 cubic feet of air (1 to 75 p.s.i.) and for intermittent operation is extremely sensitive.
Among many other uses this new unit is ideal for protecting air pressure operated machinery and instruments from corrosion and gumming.
For complete specifications and applications write today for Bulletin No. 11.

Bird-White Pur-O-fiers are also available in other models for purification of large volumes of compressed air or gas. Ask for Bulletin No. 10.

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PATENT APPLIED FOR

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Accurate, dependable popping and tight closing are built into this FARRIS Pop Valve No. 1800. Precision machining of the same calibre that has made all FARRIS Safety and Relief Valves so reliable. Light-weight, but sturdy construction for grueling service and long life. Economically priced.

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FE-506

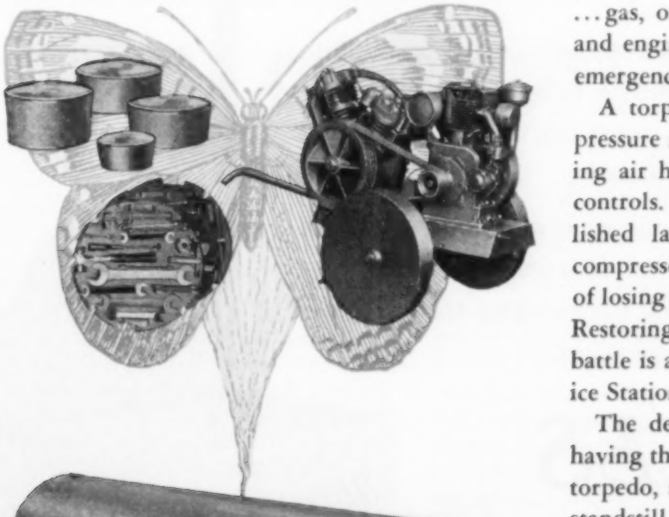
SAFETY and RELIEF VALVES

Strange Cocoons HATCH AIR COMPRESSORS

A war development that solved a problem for the Navy in the Pacific Area

This 11-foot metal "cocoon" was flown like an aerial torpedo to advance air bases. After the torpedo bomber landed, the cocoon was opened, and its tightly packed innards were quickly transformed into a complete Service Station for aerial torpedoes.

This new development, designed and built by Ingersoll-Rand, includes an I-R air-cooled portable "topping" compressor and an air-cooled gasoline engine ... gas, oil, tools and emergency repair parts for the compressor and engine ... tools for final adjustments on the torpedoes ... and emergency supplies of torpedo oil and alcohol.



A torpedo is charged with Compressed-Air Power at 2800 lb pressure for propulsion, for supplying oxygen to its alcohol-burning air heater, for spinning its gyroscope, and for operating its controls. The air-charging is usually done aboard ship or at established land bases, and Ingersoll-Rand has built hundreds of compressors for this purpose, too. But the torpedoes have a habit of losing pressure, due to testing, leakage, and temperature changes. Restoring full air pressure on the torpedoes before they go into battle is a job for the so-called "topping" compressor of the Service Station.

The design problem was to pack everything in one container having the same physical dimensions and center of gravity as a live torpedo, and yet strong enough to withstand acceleration from a standstill to 90 mph within one second.

This is another example of the diversity and magnitude of Ingersoll-Rand experience in the field of Compressed-Air Power. The Navy has made profitable use of such experience, which can also help you.

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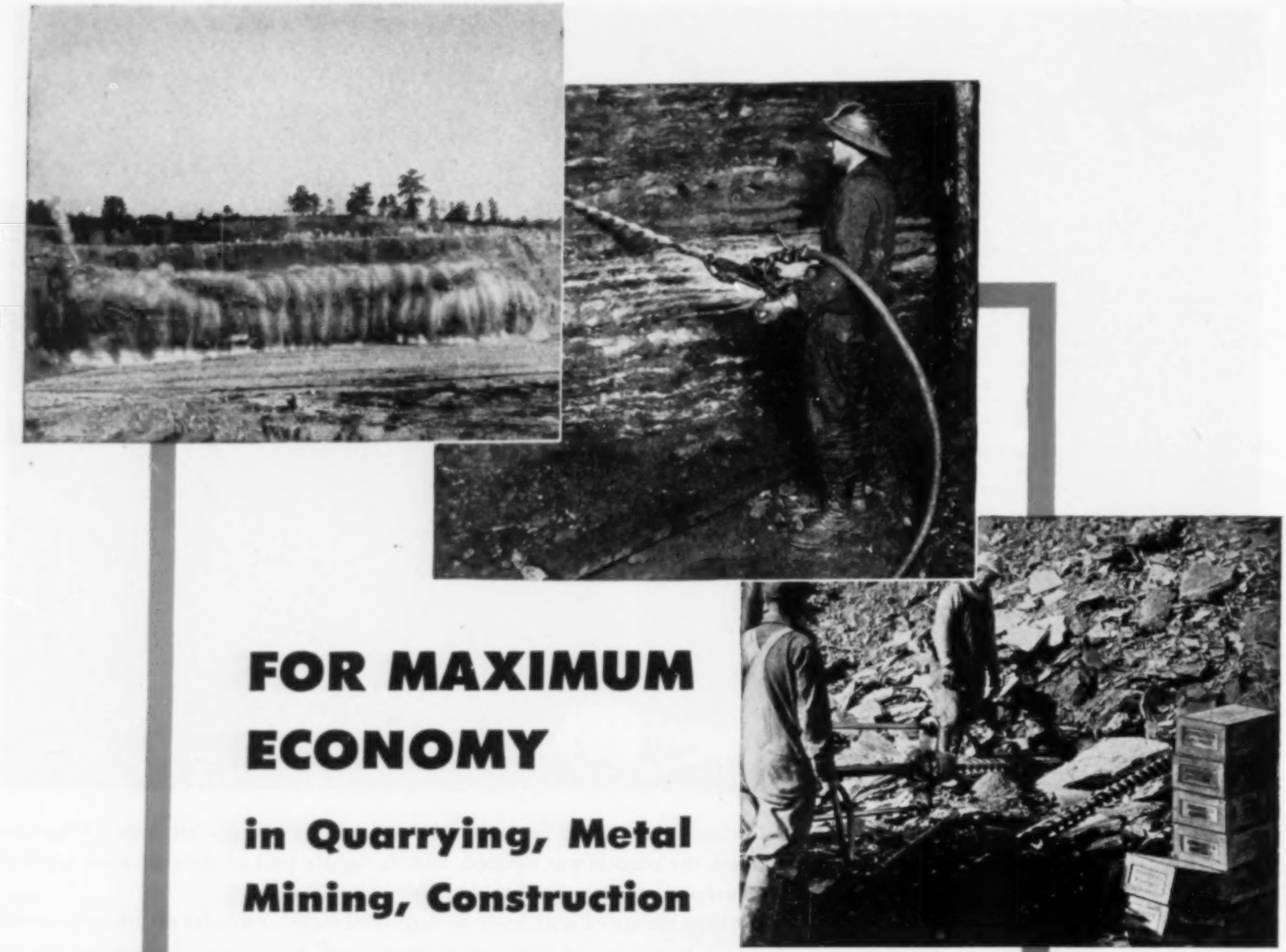
ROCK DRILLS • TURBO BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS
OIL AND GAS ENGINES



FOR MAXIMUM ECONOMY

in Quarrying, Metal Mining, Construction

Users of Hercomite* and Gelamite* report maximum breakage for every dollar's worth of explosives. Savings of 10% to 15% have been common, compared to the older types of explosives.

Hercomite and Gelamite are now more popular than ever before—the best proof of their efficiency. Yet they are but one example of many outstanding Hercules' developments in the field of explosives.

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I.C.C.-14
HERCULES POWDER
HIGH EXPLOSIVES DANGEROUS
50 LBS
HERCULES
GELAMITE
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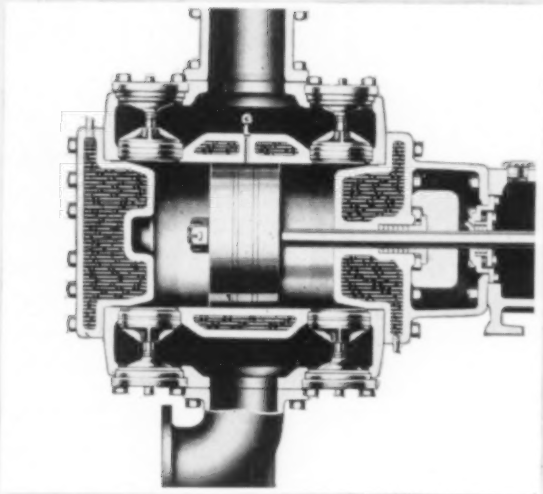
XR-54

COMPRESSOR CYLINDERS DESERVE AN OIL WITH QUALITIES

like these:



1 Low gum-and carbon-forming tendencies to prevent valve sticking.

2 Low-temperature fluidity to avoid "dry starting."

3 Low volatility to reduce carry-over to air line.

4 Rust-preventive properties to protect cylinder walls and rings.

SHELL COMPRESSA OILS

provide all these qualities

GUM FORMING and excessive carbon are usually evidence that an oil oxidizes easily. Shell Compressa Oils are particularly free of these tendencies because of special care in selecting crudes and the use of solvent extraction refining which removes all readily oxidized compounds. Not only is a minimum of carbon formed, but that minimum is soft and fluffy . . . valves stay clean and free.

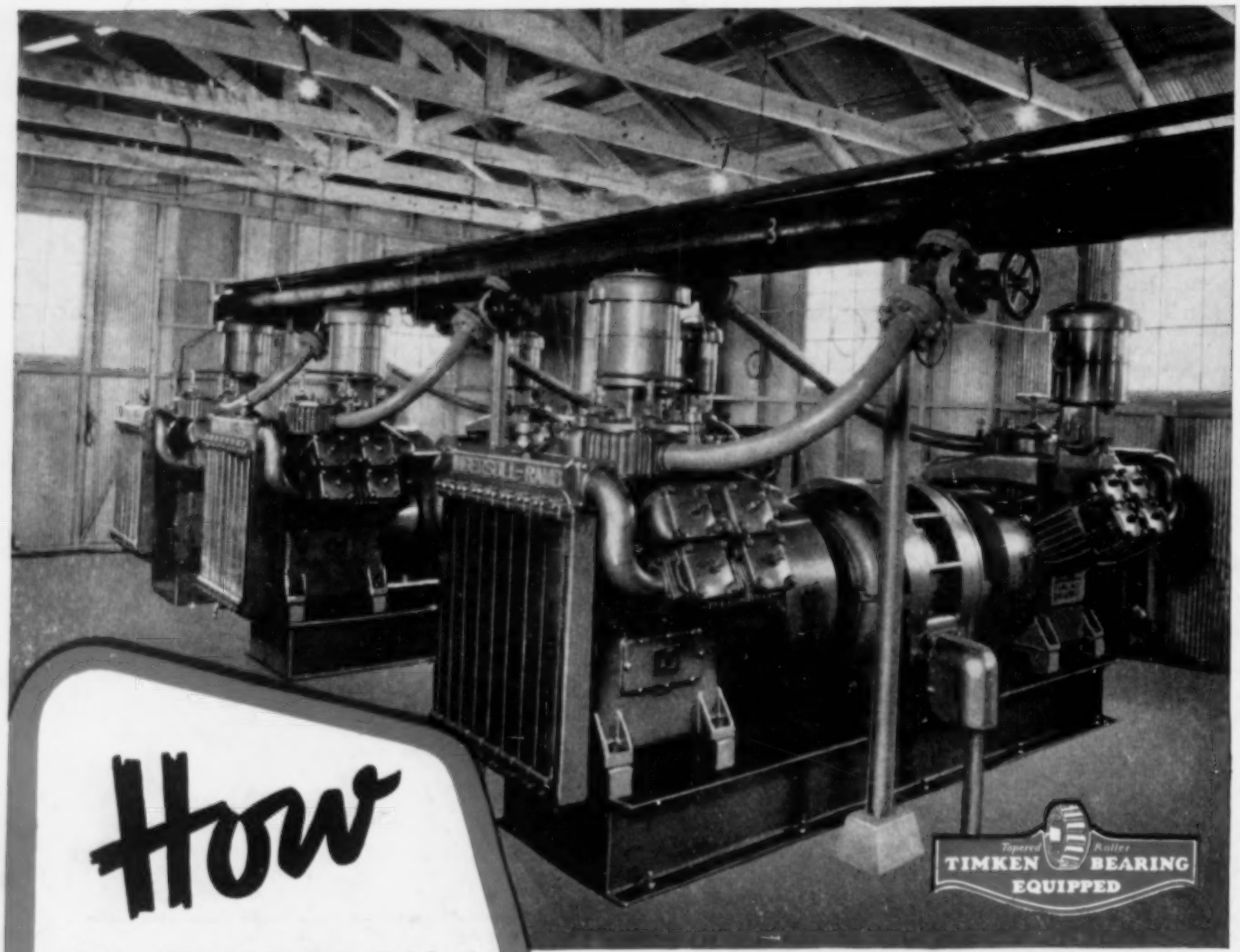
Fluidity at low temperature is necessary to protect cylinder parts both in starting and before operating temperatures are reached . . . only a well-balanced blend such as Shell Compressa Oil gives cylinder walls protection under all conditions.

Volatility has a lot to do with cylinder oil consumption. Both in the choice of crudes and in refining, those components affording low volatility are selected for Shell Compressa Oils. Result: safe lubrication with minimum feed.

Moisture conditions favorable to rusting exist in compressor cylinders, especially during shutdown. The rust-preventive properties of Shell Compressa Oils give extra protection to cylinder walls and ring edges at all times.

The Shell Lubrication Engineer will gladly give you specific advice on the lubrication of any type of Compressor. For informative literature about compressed air equipment lubrication, write to Shell Oil Company, Incorporated, 50 West 50th St., New York 20, N. Y.; or 100 Bush St., San Francisco 6, California.

SHELL COMPRESSA OILS SHELL



Ingersoll-Rand Type 40, Two-Stage, Air-Cooled Compressors operating near Blue Mountain Tunnel, Pennsylvania Turnpike.

How TO CHOOSE AN *Anti-Frictionized* COMPRESSOR

When selecting an air compressor equipped with anti-friction bearings, make sure of getting anti-friction performance in full; insist on Timken Tapered Roller Bearings.

The application of Timken Bearings on compressor crank shafts accomplishes much more than the elimination of friction. It makes full provision for carrying radial, thrust and combined loads; it holds the crank shaft assembly in correct and constant alignment; and thus extends its beneficial effects far beyond the possibilities of other kinds of bearings.

Don't specify "anti-friction bearing equipped"; say "Timken Bearing Equipped" and remove all doubt. Furthermore, look for the trade-mark "TIMKEN" on every bearing that goes in your equipment. The Timken Roller Bearing Company, Canton 6, Ohio.

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TAPERED ROLLER BEARINGS